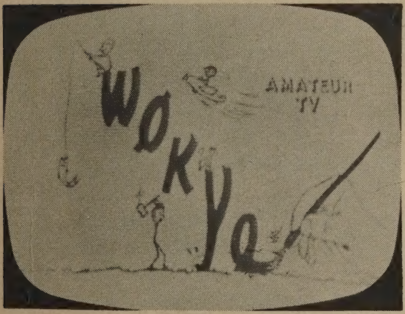
ATV EXPERIMENTER

ANTHOLOGY 1962 - 64

ARTICLES FROM THE FIRST TWO VOLUMES OF THE ATV EXPERIMENTER

ATV EXPERIMENTER EDITED BY MEL SHADBOLT WØKYQ
ATV ANTHOLOGY EDITED BY PAUL FRANSON WA4HWH



$3

a 73 publication

This book is a collection of the best construction and technical articles from the ATV EXPERIMENTER, a semi-monthly magazine devoted to amateur television. The ATV EXPERIMENTER is edited by Mel Shadbolt WØKYQ and published by 73 MAGAZINE. Since this is an anthology, some of the articles make odd references to "last month" etc. Also, some of the pages are unnumbered. I hope that these small problems do not cause too much difficulty in your use and enjoyment of this book.

Paul Franson WA4HWH

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ATV EXPERIMENTER is a bi-monthly supplement to 73 Magazine devoted explicitly to the advancement of the art of amateur television communication.

Edited by: Melvin Shadbolt, WØKYQ

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NOTES ON "FLYING SPOT" SCANNERS

Some helpful hints for selecting the CRT best suited for your individual FSS requirements.

Les Toth
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Box 415 "Personal"
Lancaster, Ohio.

Perhaps the most popular picture generator in ATV circles is the flying spot scanner. It is usually the first piece of TV equipment constructed by the newcomer to this field because of the simplicity of construction, and operation, and last but not least because of its low cost. Salvaging most of the parts from a discarded TV set can keep the cost down to as low as $20!

The foregoing notes were written to help the enterprising ham to get the best results, with parts that are most readily available.

SELECTION OF CRT FOR THE FSS

In choosing a CRT for the light source of a flying spot scanner, several factors have to be considered. There are several types of CRTs available from surplus houses, used TV sets and users of TV equipment that can be used in ATV. It is up to you to select the type available to you that will give you the most for your dollar.

Some of the factors influencing your choice are listed below:

1. Price
2. Phosphor type
3. Screen size
4. Screen shape
5. Spot size
6. Deflection requirements
7. External circuit requirements.

PRICE: This is entirely up to you. Prices range from $0.00 (the CRT from a discarded TV set) to about $200.00 for

"P" NO.	COLOR OF EMITTED LIGHT	PHOSPHOR DECAY TIME ‡
P1	green	medium
P2	blue-green	long
P3	obsolete	
P4	white	medium
P5	blue	very short
P6	obsolete	
P7	blue and yellow*	short long
P8	obsolete	
P9	obsolete	
P10	dark trace	very long
P11	blue	short
P12	orange	long
P13	obsolete	
P14	blue and red-orange*	short long
P15	blue-green and ultraviolet	short very short
P16	violet and near violet	extremely short
P17	greenish yellow*	short & long components
P18	white	medium
P19	yellow	medium long
P20	yellow	short
P21	yellow-orange	medium long
P22	red, blue, green	medium
P23	white	medium
P24	white	short
P25	orange	long
P26	yellow-orange	very long
P27	orange-red	medium
P28	yellow-green	long

Table 1. CRT phosphor chart.

‡ for scanner use, it must be medium or faster.
* indicates more than one phosphor layer.

special CRTs designed for high quality commercial flying spot scanners. Most surplus dealers have CRTs usable in FSS in the price range of $3.00 to $25.00. New CRTs usable in FSS are available from about $25.00 up.

PHOSPHOR TYPE: The phosphor type must be one of the primary considerations in choosing a CRT for a FSS. Only certain types of phosphors have the required characteristics. First of all, the phosphor should be fast, that is the decay time should be as short as possible, otherwise the "flying spot" would become a "flying streak" causing loss of picture detail and streaking. Refer to table 1 for phosphor types which are fast enough for ATV scanners.

Of these the best suitable for black and white flying spot service is the P16, which has an extremely short decay time. Unfortunately, the only way to pick one up cheap is from somebody working at a TV station, where they occasionally "retire" a tube from service, even though it is perfectly usable for ATV. Regardless of what type phosphor is used, the finite decay time of the spot has to be compensated for in the video amplifier and it is possible to use all the above mentioned phosphors successfully, provided a suitable correction circuit is used in the video preamp.

Another requirement on the phosphor is that its spectral emissivity curve must closely match the spectral sensitivity characteristics of the pickup device, the photomultiplier. Being that the only economical photomultiplier seems to be the 931, 931A or types having similar characteristics, we have to try to match the CRT to the photomultiplier. The 931A (also 931) is most sensitive to violet, however the spectral sensitivity curve is broad enough, so that it will respond to colors between blue and ultraviolet. All of the above mentioned phosphor types emit light in this region, however the one that most closely matches the 931A is a tube having a P16 phosphor. It is best to compare the spectral distribution curves before you make a decision.

SCREEN SIZE: The screen size has to be considered for several reasons. If no optics are used, the size of transparencies to be televised pretty well determines the size required. The second consideration is the resolution capability of the tube. As a general rule, the smaller the screen is, the less detail the CRT can reproduce. If you used a common 2" CRT for a light source you would have a "built-in" limitation of about 120 TV lines. It is not recommended to use a tube smaller than 5", unless it is one of the special "high resolution types", such as the 3KP series. Even in the 5" category there are several types with a limiting resolution of 250-300 lines.

SCREEN SHAPE: In most ATV flying spot scanners optics are avoided in order to cut down on cost, and in this case the objective is to get the transparency, which could be film, or glass, as close to the light source as possible. In order to do this, it is advantageous to choose a CRT with a flat face to assure that the entire picture, including the corners of a glass slide will be in focus.

SPOT SIZE: In order to get good resolution in the system it is essential that the "flying spot" be as small as possible. For a given screen size the limiting resolution of a

CRT depends on the size of the spot. The fact that small screen CRTs have inherent low resolution is due to the fact that the ratio of picture size to spot size is low, because the manufacturing process tends to limit the minimum size of the spot to no less than about 0.01" except in the case of the special (and expensive!) high resolution types. It is obvious that the smaller the spot, the larger the number of picture elements which can be reproduced in a given area. Consequently it is best to select a tube that has the smallest spot size for a given screen diameter.

DEFLECTION REQUIREMENTS: For economy and simplicity of construction a tube with magnetic deflection should be choosen, making it possible to use a discarded TV set as a deflection generator. The deflection angle of the tube should approximate that of the tube which was originally used in the set. Electrostatic deflection tubes should be considered however for compact designs.

EXTERNAL CIRCUIT REQUIREMENTS: Everything else being equal, it is advantageous to select a tube with electrostatic, rather than magnetic focus. High voltage requirements should also be considered. The highest voltage attainable with most TV sets is around 14-16KV, so if you decide on a tube requiring 25KV, such as some of the high resolution FSS tubes, you must reconcile yourself to the additional cost and work involved in building a HV supply.

CONCLUSION: Considering the factors mentioned, for most applications a 5" magnetic deflection, electrostatic focus CRT with a P4, P5, or P7 phosphor would do, however, a P11, P15, or especially P16 phosphor would be advantageous if it is within your budget. Most of the 5" tubes have resolution capabilities in excess of 350 lines, and lend themselves rapidly to transmitting 3 x 4 transparencies without the need for optics. If glass slides are intended to be used, it would be advantageous to have a tube with a flat faceplate. For high resolution systems an inexpensive tube is the 8KP4, which is capable of close to 1000 lines resolution. Its large screen presents problems however: either large size transparencies, or optics have to be used.

I hope that these notes will make it easier to select a CRT from the literally hundreds of types available; however being that the surplus market changes from day to day, I can't give you advice as to what specific type to buy, but a careful study of the surplus ads, and CRT data sheets should result in a satisfactory selection.

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SHOCKED!!

Recently while scanning over the ads in a well known magazine we ran across a new CRT utilizing fiber optics in the faceplate. The fibers direct the light from the phosphor to the front surface of the tube thus eliminating parallax....ideal for flying spot cameras using no optics. Immediately a letter was sent to the company asking about the prices. A couple of weeks later we received a reply informing us they would be glad to supply us with the cherished item. Prices were quoted as starting as low as $950 with the fancier models peaking at $6,000!!!!Project was postponed indefinitely!!

AN ELEEMOSYNARY* VIDICON CAMERA FOR SCROUNGERS

Mel Shadbolt, WØKYQ
Dakota City, Nebr.

A camera of the "live" variety suitable for everyone but specifically intended for the less experienced beginner.
Sources for cheap yokes, focus coils and vidicons also included.

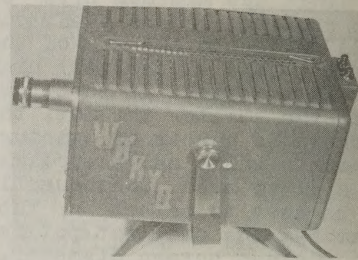
Hesitant about building a vidicon camera? Short on ATV theory? Pocketbook got the cramps? Then why not try this circuit. It's not U.L. approved or guaranteed by Good Housekeeping...but then most eleemosynary products aren't! On the other hand, it's promised to be as straightforward as practical and still incorporate a maximum number of typical scrounger items. Fair enough? Ok, then let's dispense with any further idle chit-chat and get into the meat of the subject.

SECTIONALIZED FOR CLARITY:

It's no deep, dark secret that simple circuits can be made to look overly complicated and complicated circuits overly simple. It's all in how they are drawn! To avoid any possibility of confusion (particularly to the beginner) we have chosen to sectionalize the schematic into 5 separate diagrams. It's believed that by so doing, construction errors will be reduced considerably and a better understanding of camera theory will result. They are:

1. Power supply
2. Vidicon control
3. Video amplifiers
4. Vertical deflection
5. Horizontal deflection

*Curious?? Look it up!



LAYOUT:

A suggested layout is shown below in fig. 1. It may be desirable to modify this arrangement. If so, keep these five points in mind:

1. Mount power transformer to rear of chassis behind the vidicon tube.
2. Mount video amps close together in such a manner that the 1st amp will be as near the front of the vidicon assembly as practical. Lead from target should be no longer that 3 or 4 inches.
3. Keep video leads short and direct.
4. Mount beam, target and focus pots where they can be adjusted when the camera is in its case. These are operational controls.

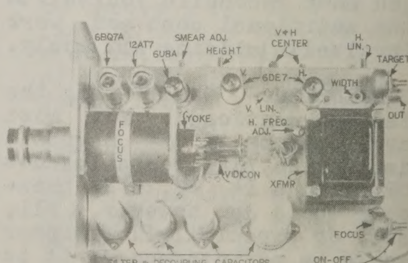


Fig. 1. Major parts layout.

5. Locate the horizontal freq adjust pot where it can be varied when camera is in its case. It may need occasional correction.

Any possibility of one or more of your nearby hamfriends constructing the same camera? If so, I urge you to consider the advantages of building the video amplifiers, vertical deflection and horizontal deflection sections on three separate plug-in chassis. This is particularly helpful if you have difficulty in trouble-shooting since it allows you to interchange the section under question with someone else who has successfully constructed the same camera.

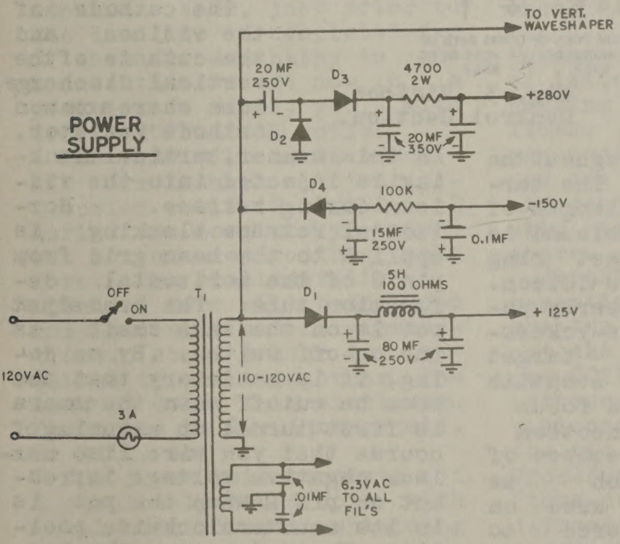
POWER SUPPLY:

The power supply requires very little explanation. See fig. 2. Any power transformer capable of furnishing 110-120 VAC at 100 ma and 6.3 VAC at 3 amp will work in this circuit.

A standard half-wave rectifier feeding a capacitor input LC filter network provides the +125 volts required by the deflection output stages and the video amplifiers.

Another half-wave rectifier connected in the opposite manner feeding a capacitor input RC filter provides the -150 volts required for biasing the vidicon beam.

The +280 volts for the vidicon, vertical discharge and horizontal oscillator is derived from the same 120 volt winding by using a standard voltage doubling circuit. The 20mfd capacitor in series with D3 is charged up to the peak value of the secondary through D2 on the negative cycle. This is then added to the output on the positive cycle when D3 is in a conducting state and D2 is cutoff. This configuration allows a single 120 volt winding to furnish all the required B voltages, thus making it feasable to use cheaper and more readily available transformers.



D1, D2, D3 & D4-Any silicon diode over 100 ma and PIV of 400 volts.

Fig. 2. Power supply section.

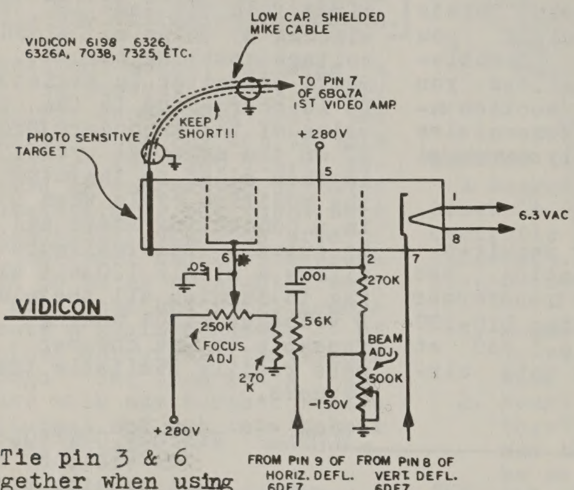
VIDICON CONTROL:

The vidicon control section refers to all the circuitry directly related to the vidicon itself and is shown on the opposite page.

The focus and yoke assembly, although related to the vidicon are not shown in this diagram since they are more clearly shown in the deflection sections. Even so, we must consider the location and space they will occupy before going any further. The complete assembly.. ..that is, the focus coil and the deflection yoke...takes up a space of about 2½" square by 3" deep.

This is mounted to the front panel of the camera. Prior to mounting, a hole must be cut out of this panel the diameter of the focus coil. This hole serves two purposes; (1) it allows the light from the lens to strike the photosensitive target area of the vidicon (2) it provides a means of inserting and removing the vidicon.

The beam, target and electrostatic focus pots are mounted on the rear panel where they



* Tie pin 3 & 6 together when using 6326 vidicon.

Fig. 3. Vidicon Control Section.

can be adjusted throughout the period of operation. The target lead is a short length of low capacity mike cable and is connected to the target ring near the front of the vidicon. The vidicon when properly positioned in the focus-yoke assembly will have its target ring almost directly even with the front edge of the focus coil. The target connection need only be a little piece of springy material, such as phosphor bronze (as used on relay contacts) soldered to the end of the signal lead. It can be held in proper position for the target to press against by a small piece of plastic glued to the inside of the focus coil. The target lead should be brought through the front end plate of the focus coil (through a small hole drilled to the required size), down through the chassis and directly to pin 7 of the first video amp. BE SURE the shielded target cable is grounded to the electrostatic shield of the focus coil and that the exposed signal lead (including the small piece of springy material serving as the target connector) is kept absolutely as short as possible! This is necessary so that the retrace pulses of the horiz. deflection coils are not capacitively picked up by the target lead. If this should happen it will appear as a ringing near the left edge of the picture. If severe enough it can cause amplifier overloading.

The cathode of the vidicon and the cathode of the vertical discharge tube share a common cathode resistor. In this manner, vertical blanking is injected into the vidicon during retrace. Horizontal retrace blanking is applied to the beam grid from pin 9 of the horizontal deflection tube. The beam adjust pot is on the same shaft as the on-off switch. By so doing, it is mandatory that the beam be cutoff when the camera is first turned on assuming of course that you wire it so maximum negative voltage is present on pin 2 when the pot is in its counterclockwise position. Never decrease the beam bias until the deflection tubes are functioning properly. It could burn a spot on the delicate photosensitive target!!

Focus and Yoke Coils:

If some of you were becoming concerned whether or not we had forgotten to give the gory details for winding your own focus and yoke coils...rest at ease! We plan to present a complete and fresh approach to this pesky little problem next month. It will not be a mere rehash of previously published data copied directly from manufacturers design notebooks. On the contrary, it will be a down-to-earth practical explanation of the problem complete with all necessary figures, winding hints and assembly procedures.

However, I must warn you we most certainly haven't taken the work out of it...we have only revamped the procedures so they are more adaptable to the home constructor. It's still WORK! To offset this slightly pessimistic view I have some more encouraging news. Dick Wright, WØDAM and myself have worked for several weeks on a practical coil winding machine. Well, just prior to the deadline we completed two of them and are happy to announce that we are now in a position to supply you with truely ECONOMICAL coils.

The yoke will be in a semi-kit form in which all four deflection coils (2 vert & 2 horiz) are completely wound but not mounted to the yoke form. The electrostatic shielded form will be included complete with assembly instructions. About ½ hour is required to put it together. You save by doing this simple step. The price is $9.95 postage paid. S- fig. 4.

The focus coil consists of a completely wound coil with total electrostatic shielding ready to mount. It is also shown in fig. 4. The price is $11.95 postage paid. Order both and save $2.00...set only $19.90. This is truely an

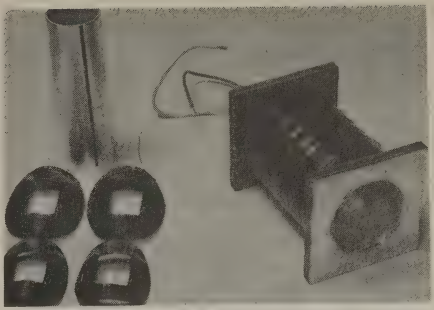


Fig. 4. (left) Yoke coils and shielded form...assembly info not shown. (right) Focus Coil.

eleemosynary offer...we stand very little to gain considering the time involved...yet you save yourself days of grief!! I wouldn't advise you to wait though...in two months we may decide to say UNCLE! Send your orders to:

ATV EXPERIMENTER
Dakota City, Nebr.

The Vidicon:

Prior to purchasing a vidicon we strongly advise you to check with all local TV stations. We have been receiving an ever increasing number of letters from fellows reporting success along these lines. Explain to them that you need it for an ATV camera you are constructing. Chances are good you won't only end up with one but perhaps even a spare. Give it a try!

Another source which was recently drawn to our attention are the military bases throughout the country. Many of them use CCTV for remote monitoring purposes. They change the vidicons regularly, tossing the old ones into the junk! Procedures for obtaining these "toss-outs" are not too well defined yet. We are simply passing the info on to you for what its worth. Out of the 2 we located, one was in very good condition with the exception of a spot of fuzz on

the target (still acceptable by amateur standards) and the other one was down somewhat in emission...but still producing a fairly good picture.

VIDEO AMPLIFIER SECTION:

The signal from the vidicon target is direct coupled into the grid of the 1st video amplifier, ½ of a 6BQ7A. The 68K grid resistor for this stage also serves as the target signal load resistor...the bottom end of which is returned to the junction of a 220 ohm resistor and a 50K pot in the cathode. By varying the 50K pot the required target voltage is applied to the vidicon through the 68K resistor. Generally the target is operated at a potential between +5 to +25 volts.

To correct for capacitive shunting effects on the higher video frequencies a variable "smear" correction pot is incorporated in the plate circuit of the 2nd video stage. This pot is adjusted for minimum smear following any large black or white object. The signal is still further amplified (after correction) by a 2 stage 12AT7 circuit.

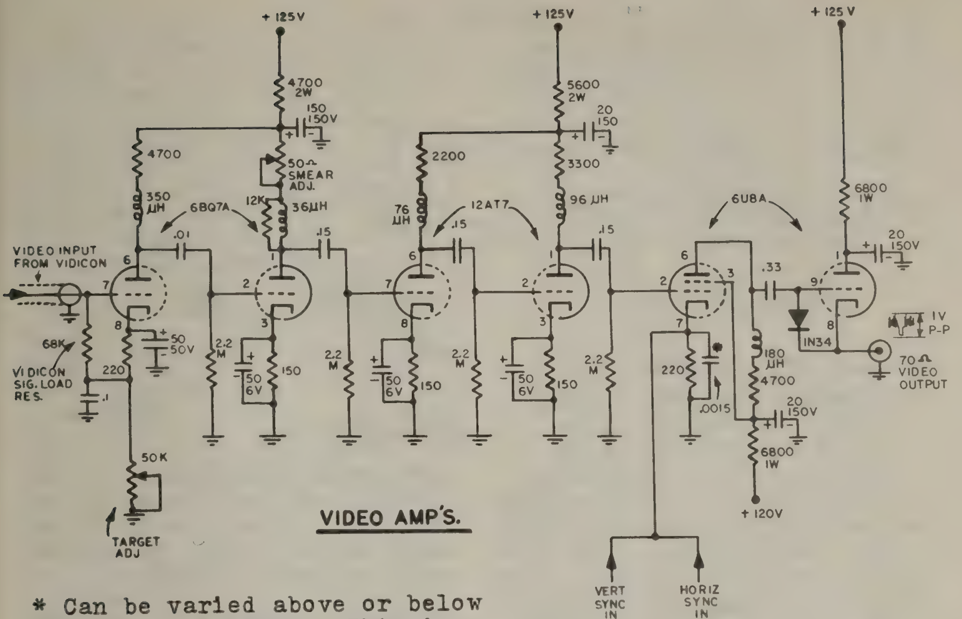
The output of the 2nd section of the 12AT7 is then fed to the pentode section of a 6U8A where the vertical and horizontal sync/blanking pulses are inserted. The output of this stage is then DC restored and fed to the triode section of the same tube where it is converted to a low impedance signal suitable for feeding a 70 ohm coaxial cable.

Now for a few words of caution!

1. Connect the 68K signal load resistor very near pin 7 of the 6BQ7A.
2. Target adj pot should be mounted where it can be adjusted while the camera is in operation, as stated previously. However, for added protection, we suggest you use shielded cable for connecting between it and the junction of the bottom end of the 68K sig load and the 220 ohm cathode resistor.
3. Be sure the output of the 6U8A cathode follower is terminated near 70 ohms at the monitor (or modulator which ever the case)! It won't function otherwise. A 68 or 82 ½ watt resistor is close enough.
4. The smear adj pot must be located near the 6BQ7A. It is not an operational control. Once set, it requires no further adjustment unless a tube (or some other component) is changed.
5. Adjust the target for the correct video to sync ratio as shown in fig. 5. 75% video-25% sync. In effect it can be considered a contrast control. However, too high a target setting will produce a picture with poor shading. Avoid such settings whenever it is possible to either raise the light level or open the iris on the lens. A better picture will result.

When wiring the video section take your time and follow good wiring techniques. Use short leads...avoid haywiring! The improved results will be more than worth the little extra effort.

The values of the peaking coils are not overly critical. If you wish to wind your own you will find complete details in our article "Peaking Coils"



* Can be varied above or below this value slightly. This is a high frequency boost capacitor. Adjust for desired "crispness" of picture.

Fig. 5. Video Section.

VERTICAL DEFLECTION:

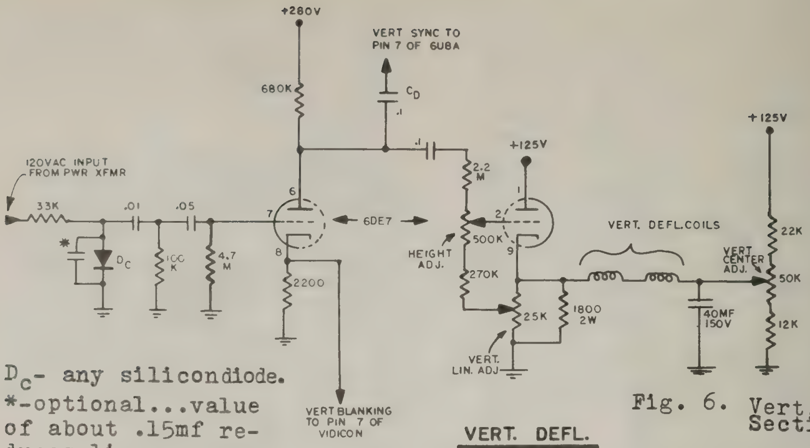
For this section of the camera refer to Fig. 6 on the next page. Only 1 tube required, a 6DE7.

A portion of the 60 cps voltage from the secondary of the power transformer is coupled through a waveshaping network to the grid of the first section. The plate circuit of this stage is connected to an RC type discharge network consisting of C_d and the 220 ohm cathode resistor of the 6U8A sync inserter. This network serves two purposes: (1) At the junction of C_d and the 220 ohm resistor a pulse is present suitable for vertical sync. (2) The linear charging rate of C_d modifies the signal normally present at the output of this tube into a sawtooth waveform.

This sawtooth signal is capacitively coupled through a gain control (height adjust) to the grid of the second section. The grid return connects to the arm of a 25K pot in the cathode (linearity adj). This allows the grid bias to be varied of a wide range in order to further correct the waveform thus insuring maximum vertical linearity. The deflection coils are connected between the cathode and a variable DC source. This allows the DC current flowing through the coils to be varied for the purpose of vertically centering the raster on the vidicon target.

As stated earlier, the 2200 ohm resistor in the cathode of the first section also serves as the vidicon cathode resistor. By sharing a common resistor the pulse present at this point drives the vidicon into cutoff during retrace.

If you wish to check the current flowing through the vert coils you can insert a low value resistor...about 22 ohms.



D_C- any silicondiode.
*-optional...value of about .15mf reduces line surges.

Fig. 6. Vert. Section.

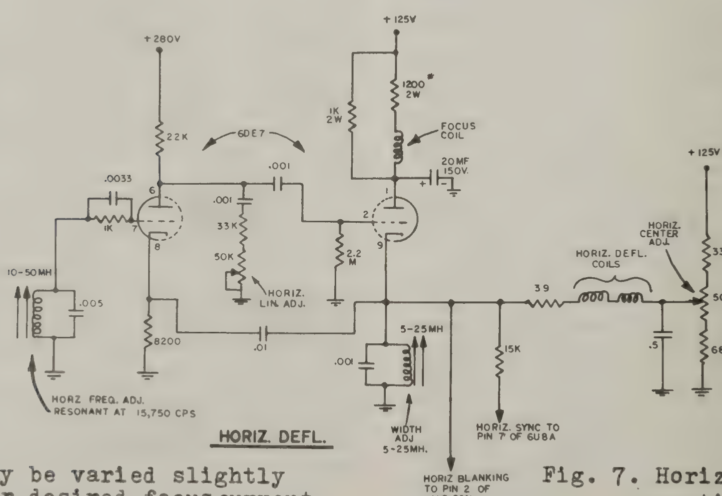
...in series with the coils. Then attach a scope across this resistor and check for a good linear sawtooth waveform. Remember, you must check the current flowing through the coils (not the voltage across them) inorder to determine true linearity of your sweep. This is due to the fact that the coils are inductive and to overcome this the voltage signal driving themmust be predistorted inorder that the signal current be linear. This is even more predominant in the higher frequency horizontal coils.

HORIZONTAL DEFLECTION:

This, the final section to the eleemosynary camera is shown below in fig. 7. It also requires only one 6DE7.

A cathode coupled multivibrator circuit is incorporated with an LC ringing network in the grid circuit of the 1st section for frequency stabilization.

The signal present at the plate of pin 6 is modified by the discharge network consisting of a .001 capacitor in series with a 33K fixed resistor and a 50K pot. The pot serves as a linearity adjustment.



*May be varied slightly for desired focus current.

Fig. 7. Horiz. Defl. section.

The horizontal coils are connected between the cathode of the 2nd section and a variable DC source...much like in the vertical deflection section.

The variable coil from pin 9 to ground not only serves as a width coil but also aids in producing a much nicer sync-blanking pulse than if an RC network had been used.

The focus coil is isolated from the output by placing it in the plate circuit of this stage. Pin 1 is bypassed with a 20mfd capacitor, therefore the current flowing through the focus coil is pure DC. The current dividing resistors, the 1K and the 1.2K in series and in shunt with the coil allow the correct voltage to be applied to pin 1 yet limit the current through the coil to a desired value of about 30ma. NOTE: As some might first assume, the focusing of the vidicon is not "fine adjusted" by varying the current through the focus coil. Instead, the "fine adjustment" is accomplished with the electrostatic control connected to pin 6 of the vidicon.

Sync and blanking pulses for the vidicon and sync inserter are obtained from pin 9.

continued on next page

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PEAKING COILS ...WØKYQ

There's really no reason to pay out $.50 a piece for peaking coils in your video projects when they can be made for virtually nothing in about 5 minutes. All that is needed is some old 1 watt resistors (standard IRC diameter) which are any value greater than 100K (these act as forms) along with some enamelled wire...#36.

From the chart, pick the required inductance and the num- of turns needed. Start out by notching the ends of the resistor. This will prevent the wire from sliding off the ends while winding. Solder the end of the wire to one of the pigtails and proceed to random winding the required number of turns on the resistor taking care not to wind to near the edges. Solder the remaining end on the other pigtail. You now have a video peaking coil. For greater durability coat it with a layer of Q dope.

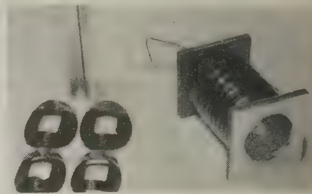
All coils wound with #36 wire.

10 uh - 55 turns
15 uh - 65 turns
20 uh - 75 turns
36 uh - 100 turns
73 uh - 145 turns
93 uh - 160 turns
120 uh - 175 turns
180 uh - 200 turns
250 uh - 250 turns
470 uh - 340 turns

AN ELEEMOSYNARY* VIDICON CAMERA FOR SCROUNGERS

Mel Shadbolt, WØKYQ
Dakota City, Nebr.

PART II: Winding the focus and yoke coils. Operational checkout.



By this time I imagine a good many of you are ready to begin winding the focus and yoke coils. As promised last time, we don't have any revolutionary shortcuts guaranteed to take 100% of the drudgery out of this phase of the camera construction...however, we can promise one thing. Nothing has been taken for granted! NO STEP is considered unimportant... we know only too well how difficult a project can be made when seemingly unimportant items are purposely omitted from an article. Exasperating!

How about it? Are you game?? OK, let's get started!

COLLECTING MATERIALS: A great deal of time and energy will be saved if you will follow the steps in the exact manner layed out in the next few pages. DON'T attempt to re-arrange the steps. It will only cause undue difficulties to arise during some later stage of assembly, quite likely resulting in a finished product which is somewhat less than ideal...even by ATV standards.

Begin by collecting ALL the necessary materials listed below in Table 1. Don't even consider starting until every item has been obtained.

TABLE I — Materials required for winding focus & yoke coils.

MATERIALS	PURPOSE
¼ lb (less if available) #36 enameled wire	For vert. yoke
1 lb #32 enameled wire	For horiz. yoke & focus coil
1 Reynolds Aluminum foil tubing	For focus coil form
1 x 4 inch cardboard tubing (Cover from 1" filter capacitor is just right)	For yoke form
Good all-purpose glue (Pliobond, Epoxy, etc)	To secure shields and end plates
Good general purpose coil dope (Liquidope, "Q" Dope, etc)	For securing the yoke coils
4 pieces of ¼" plywood, bakelite, plastic or phenolic, 2½ " square.	2 for focus coil end plates & 2 for making yoke jig.
Plastic electrical tape	For securing coils in place and covering
Small amount of household aluminum foil	For the shields
Insulated hookup wire (abt 3')	For coil leads

FOCUS COIL FIRST: Since the focus coil is the easiest let's begin with it.

On the opposite page you will find the complete procedure clearly illustrated in 9 easy-to-follow steps. Steps 1 thru 7 are self-explanatory but steps 8 and 9 need some discussion.

STEPS 8 & 9 — FOCUS COIL:

By the time you have completed step 8 you are about ready to start winding. Proceed as follows:

1. Knowing speed of drill, determine correct number of minutes and seconds required to wind the 6500 turns. REMEMBER: The drill will be loaded very lightly, so near-maximum speed (as indicated on drill) will be accurate enough to retain the ± 1000 turn tolerence.

2. Using gloves (to prevent burning hands) to guide wire back and forth, have someone start the drill.

3. NOTE: The coil is random wound. Merely guide the wire back and forth the length of the form at a fairly steady rate...watching that the wire builds up smothly across the complete length of the coil. If it should start getting thicker at one point, correct by guiding the wire past this point a little faster for several layers. You will have some 5 minutes or more so if you get a ruff start you will have plenty of time to correct for any high spots. No insulation is required between layers, so the actual winding process will progress quite rapidly.

4. At the end of the calculated time, stop the drill and temporarily secure the loose end of the wire. Clean both ends and measure for continuity...it should be somewhere near 430 ohms ± 50 ohms.

6. Solder short lengths of insulated hookup wire to each lead. (Make each lead about 6" in length...longer if needed.) Pass leads through the 3/16" hole in the rear end plate.

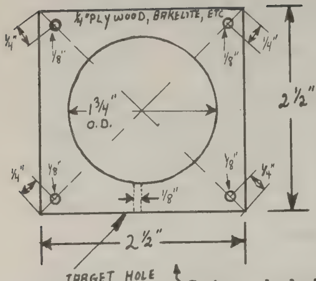
7. Apply 2 layers of plastic electrical tape over entire coil.

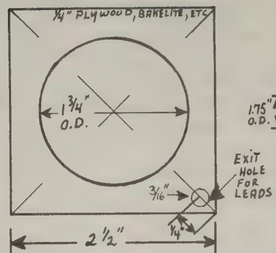
Step 9 is concerned with the electrostatic and electromagnetic shielding details. Continue as follows:

1. Both the inside and the front of the focus coil are covered with an electrostatic shielding. This is made from ordinary household aluminum foil. A piece 5¼" in length is required to go around the inside of the form...allowing for a slight overlap. The width should be made slightly greater than the total length of the focus coil...say about 4-5" long. The excess can be trimmed off later.

2. Form the foil so it will slide easily into the focus form. Next apply glue to the inside of the form and insert the foil. Smooth down with a dowel or other smooth object. Cut off excess from each end with a sharp knife.

3. Now take a piece of foil about 3" square and glue to the front end plate. Trim edges and punch out the four 1/8" mounting holes. Next, cut out the 1-3/4" vidicon hole...... leaving about 1/8" foil all the way around which can





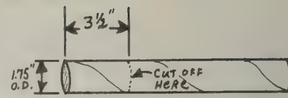
Cut and drill as shown

FRONT END PLATE
FOR FOCUS COIL

STEP 1

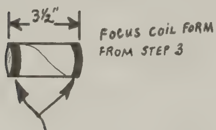
REAR END PLATE
FOR FOCUS COIL

STEP 2



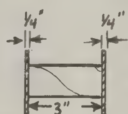
Reynolds household aluminum foiltubing used for focus coil form.
Mark $3\frac{1}{2}$" from one end and cut off.
Save $3\frac{1}{2}$" piece.
Discard remainder.

STEP 3



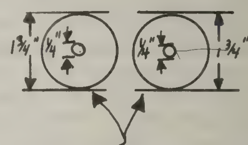
Build up ends with tape if necessary to make tight fit for the end plates.

STEP 4



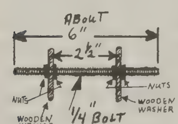
Apply glue to both, form and end plates. Slip end plates onto form as shown.

STEP 5



Make two identical wooden washers as shown.

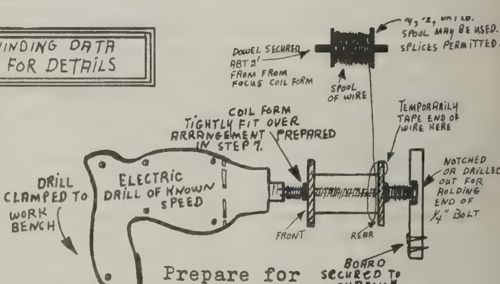
STEP 6



Prepare a $\frac{1}{4}$" x 6" bolt as shown above, placing two nuts about 1-3/4" from each end. Then place the two washers from step 6 on the bolt and tighten in place with 2 more nuts.

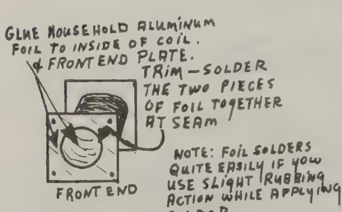
STEP 7

FOCUS COIL WINDING DATA
SEE TEXT FOR DETAILS



Prepare for winding as shown.

STEP 8



STEP 9

After winding has been completed glue shield to front and inside of coil form. NOTE: The closed loop of aluminum shielding inside the focus coil will not effect the operation of the coil since it will have DC current passing through it. Solder front shield to inside shield.

COILS	No. REQUIRED	No. TURNS	WIRE SIZE	APROX. RES.
Focus	1	6500 ± 1000	#32	430 Ω
Horiz.	2	@250 ± 25	#32	@15 Ω
Vertical	2	@625 ± 25	#36	@90 Ω

TABLE II—VIDICON FOCUS AND YOKE COIL CHART

be folded inside, over the other foil. Solder the two pieces together along this seam.

NOTE: Surprising as it may seem, the aluminum foil solders quite easily if a slight rubbing action is used with the iron as you apply the solder.

THIS FINISHES THE FOCUS COIL, UNLESS YOU WISH TO ADD A MU-METAL SHIELD.

OPTIONAL: To avoid external magnetic fields from the earth, power transformer, filter choke, etc a mu-metal shield may be desired.

Its necessity will be indicated by a distorted picture, poor focus and/or difficulty in retaining correct centering. If needed apply the necessary amount directly over the taped coil.

Note: Mu-metal is extremely hard to locate in small quantities. ATV EXPERIMENTER has therefore purchased a large order and is now prepared to supply you with the exact size required to cover your coil. A single layer will provide an 8:1 reduction at 60cps. Your cost is $1.75 postpaid. A dual layer (highly recommended) will provide 4 times the attenuation of a single layer ...in other words, a 32:1 reduction at 60cps! Your cost is $3.00 postpaid. It's very easy to handle due to the dead softness of the material. Send orders to:

ATV EXPERIMENTER
DAKOTA CITY, NEBR.

THE YOKE IS NEXT: Although the the illustrations shown on the opposite page are quite self-explanatory there are a few points which need clarification, so let's quickly run through the complete procedure.

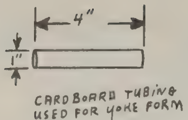
1. The yoke form comes from the cardboard cover used over electrolytic capacitors to protect you from shock when the can is above grd. If you don't have one in your junk box you can probably locate one at the local TV distributor or nearby service shop.

2. The electrostatic shield is made as shown in step 2 out of ordinary household aluminum foil. The slits prevent the high frequency horizontal scanning field from being partially short-circuited by the otherwise shorted turn of aluminum foil.

3. If desired, the foil can be made slightly longer than the 4" shown and then trimmed to the exact size after it has been glued to the form. Use whichever procedure is the simplest for you.

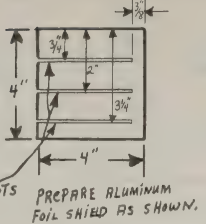
4. Solder a short flexible ground lead onto the rear end. This lead should be kept short...3 or 4 inches. Tin the foil prior to attaching the wire. This is best accomplished by lightly rubbing the area to be tinned with the tip of the hot iron as you are applying the

DRAWINGS NOT TO SCALE



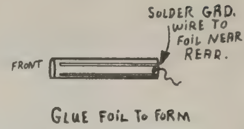
Yoke form made from 1" x 4" cardboard filter capacitor cover.

STEP 1



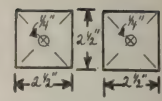
Household foil.

STEP 2



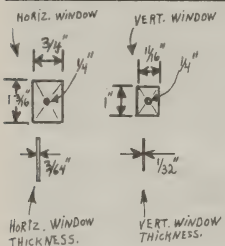
NOTE: Open ends to rear. Put layer tape over entire shield.

STEP 3



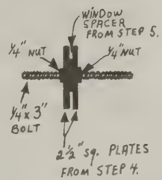
Prepare 2 wooden forms for winding coils as shown.

STEP 4



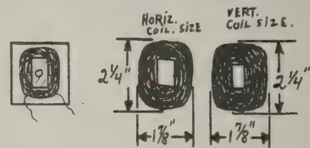
Windows made from copper, aluminum, etc. Used for spacers when winding coils. Size and thickness determines how large the coil will grow.

STEP 5



Prepare winding jig as shown above.

STEP 6

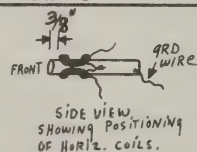


Hand wind required number of turns on jig as prepared in step 6. Lift one side off and apply coil dope. See text for exact details on how to handle. Size of coils should be 10-15% of the sizes shown.

STEP 7

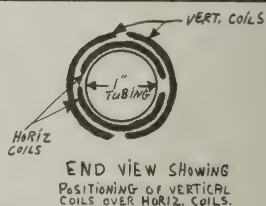
Once coil has started to set form on 1" tube. Hold in place until glue is firm. See text for exact details. Do this to both horiz and both vert coils.

STEP 8



At completion of winding, position horiz. coils on form first exactly opposite each other. See text for proper connections, to insure correct phasing. Add insulated hookup wire for leads. Tape in place.

STEP 9



Position vertical coils directly over horizontal coils but 90° displaced. Connect as per text. Add leads and finish taping.

STEP 10

YOKE WINDING DATA
SEE TEXT FOR DETAILS

solder. Avoid excessive rubbing and heat...the foil is quite thin.

5. Put a single layer of tape over the entire shielded form and set aside for the time being.

6. Prepare the remaining two pieces of plywood as shown in step 4. These are used in conjuction with the window spacers shown in step 5 to form the coil winding jig shown in step 6.

7. Once the jig has been assembled you are ready to start winding the coils. REMEMBER: Use the correct window spacer and wire gauge ...otherwise the finished coil will not be the correct size.

8. Actual winding is done by hand. Dont let this alarm you though...it will progress quite rapidly. There are no time-consuming intermediate steps, such as lacing the four corners every few dozen turns...a procedure used in former yoke construction articles. The coil will build up nicely from start to finish.

9. Holding the jig in one hand begin winding on the wire with the other. Keep accurate count. Once the winding is completed, secure the loose wire ends temporarily with a small piece of tape. While holding the jig horizontally, CAREFULLY loosen the top nut and remove top plate. The coil will appear as shown in Step 7. Don't try to remove it from the plate yet ...and don't be concerned if a few turns spring up. This will be corrected shortly.

10. Apply a generous amount of coil dope, such as "Q" dope or Liquidope and allow it to set for a few minutes. With the end of a screwdriver, you can press down any loose wires as the glue starts to get sticky. When semi-firm, carefully loosen with a knife blade and flop over. Once again apply coil dope and press down any loose wires. Wait a few minutes till the glue starts to set, then remove the window spacer.

NOTE: The size should be within 10-15% of the values shown in step 7...if not, recheck size and thickness of window...also the wire gauge!

11. In about 5-10 minutes you will be able to handle very easily and then you can pre-form it on the 1" yoke form. Hold it in place till dry. You will notice as the glue begins to set you can further shape the coil by squaring up the corners and centering the window. When all coils have been wound and are thoroughly dry they can be mounted on the form.

12. Refer to step 9 when mounting the horizontal coils. Place them opposite each other (180°), 3/8" from the front end of the form. SECURE TEMPORARILY in place with a small piece of tape making certain to leave the four leads exposed.

13. Next step is to tie the two coils together so they are aiding not bucking. Grasping the outside lead of one coil tug on it a little to determine if it is unwinding in a clockwise or counter clockwise direction. Once determined do the same thing to the outside lead of the other coil. If they are both going

the same direction, tie the two outside leads together. If they are going opposite directions tie the outside lead of one to the inside lead of the other. To the remaining two leads add insulated hookup wire of the required length. Finish taping...one layer of plastic electrical tape is sufficient. Pull it tight as you wrap it over the coil so it will keep the coils formed snuggly around the form.

14. The outline of the horizontal coils will be clearly visible through the tape. The vertical coils are now placed directly over the horizontal coils. Place the the two coils opposite each other (exactly 180°) but 90° displaced from the horizontal coils. See the end view illustration shown in step 10.

15. Repeat the same procedure for connecting the coils togetheras explained for the horizontal coils.

16. Add insulated hookup wire to the two remaining leads and finish taping. Once again, draw the tape tight to keep the vertical coils snuggly formed over the horizontal coils.

THIS COMPLETESTHE YOKE!!

You will find that it just fits nicely inside the focus coil...no additional mounting hardware is required.. ..once the vidicon is inserted and plugged into its socket the yoke will remain securely in place.

One final point which should be made at this time concerns the wrapping of iron wire over the top of the entire yoke...this was a procedure described in some previous camera construction articles. It resulted in more sweep efficiency since the flux was coupled between the coils through the iron wire rather than through the air. However, it was an unnecessary item since the vidicon sweeps <u>very</u> easily.

OPERATIONAL CHECKOUT: On the following two pages you will find the complete schematic of the eleemosynary camera with all necessary waveforms, voltages and resistance readings. The values are typical and can vary over a reasonable range from those shown.

This leaves us with only one item of unfinished business.. ..the tuneup procedure. I had though we would get it in this issue but once again, space is at a premium. Since it is a subject which should not be covered lightly we will carry it over to the next issue.

Till then, best of luck with the winding...don't forget, if it all looks like too much, we can still provide you with the complete set for $19.90. Or, if you would like to wind one but not the other we also have them available separately. The focus coil is complete and ready to go...for $11.95 PP. The yoke includes the shielded form, all coils pre-formed, marked and coded plus easy-to-follow directions...only $9.95 PP. (Requires about 30 minutes to assemble.)

ORDERS SHOULD BE SENT TO:
ATV EXPERIMENTER
DAKOTA CITY, NEBR.

Remember: Next month, complete tuneup instructions.

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COMING SOON BY POPULAR REQUEST
Ed Baker, WØEDO, Independence, Mo. is working up a construction article on an interlaced sync generator as per his article in the April-May issue.

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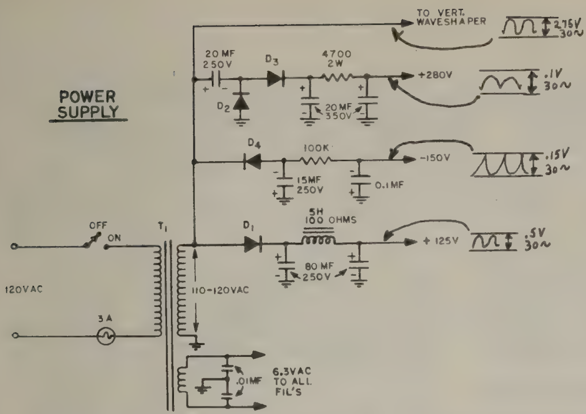


Fig. 1. Schematic of Eleemosynary vidicon camera showing waveforms.

TABLE III TYPICAL VOLTAGE READINGS FOR ELEEMOSYNARY CAMERA.

TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
Vidicon	6.3ac	-50*	70-200‡	I.C.	280	70-200‡	.55	6.3ac	—
6BQ7A	82	—	.78	6.3ac	6.3ac	70	—	+15	0
12AT7	87	—	.25	6.3ac	6.3ac	90	—	.3	6.3ac
6U8A	82	0	74	6.3ac	6.3ac	68	1.25	.4	-1
6DE7 (V)	125	—	—	6.3ac	6.3ac	44	-22	.55	31
6DE7 (H)	85	—	—	6.3ac	6.3ac	230	—	18	5

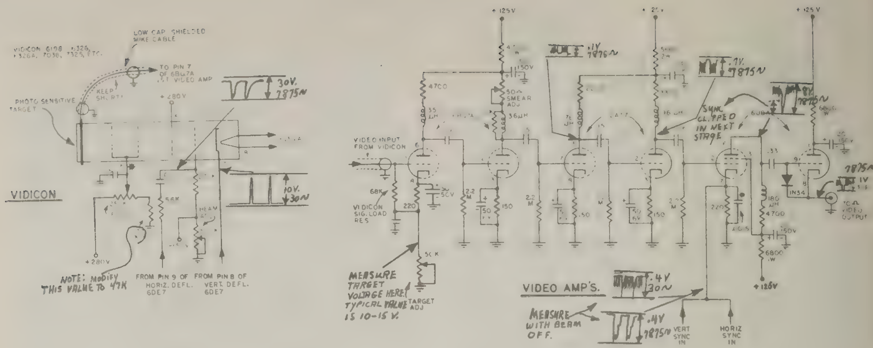
*Adjusted for pix, varies with different vidicons.
‡varies with focus coil current. Adj focus current so focus V. will fall within this range. NOTE: 6326A has pin 3 & 6 tied together.

ALL READING TO GROUND EXCEPT FILAMENTS
READINGS TAKEN WITH 20,000 per volt meter.

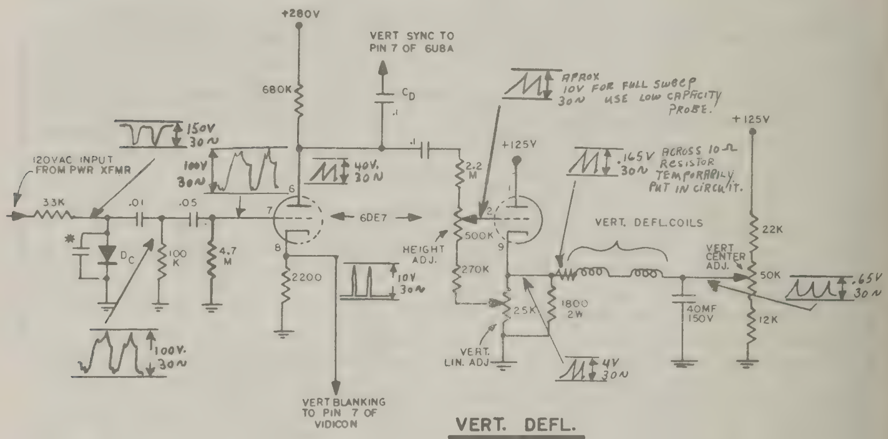
TABLE IV TYPICAL RESISTANCE READINGS FOR ELEEMOSYNARY CAMERA.

TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
Vidicon	∞	770K*	36K*	NC	135K*	36K*	2200	∞	—
6BQ7A	38K*	2.2M	150	∞	∞	44K*	83K‡	6K‡	0
12AT7	43K*	2.2M	150	∞	∞	42K*	2.2M	150	∞
6U8A	40K*	2.2M	42K*	∞	∞	47K*	220	72@	••450@
6DE7 (V)	32K*	630K•	—	∞	∞	1M*	4.7M	2200	1750
6DE7 (H)	31K*	2.2M	—	∞	∞	160K*	1040	8200	80

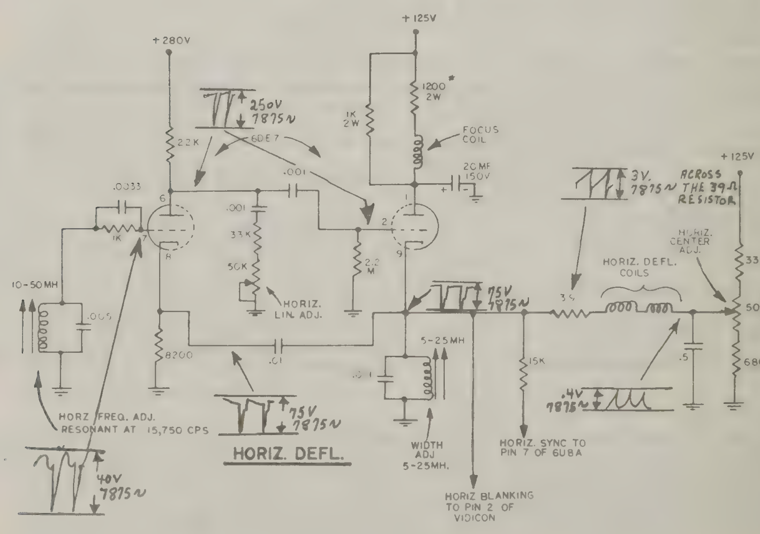
*Readings taken with electrolytics connected in circuit. These values will vary according to leakage...these are consider average.
‡Varies with target setting.
@Taken with output terminated with 72 ohm resistor.
•Varies with height setting. •• Varies slightly with diodes.



LOW CAP SHIELDED MIKE CABLE
VIDICON 6198, 6326, 7038, 7325, ETC.
TO PIN 7 OF 6BU7A V1 VIDEO AMP
KEEP SHORT
PHOTO SENSITIVE TARGET
+280V
30V. 7875~
10V. 30~
+280V
NOTE: MODIFY THIS VALUE TO 47K
FROM PIN 9 OF HORIZ. DEFL. 6DE7
FROM PIN 8 OF VERT. DEFL. 6DE7
VIDICON
+125V
.1V 7875~
.1V 7875~
SMEAR ADJ
SYNC CLIPPED IN NEXT STAGE
6UBA
7875~
VIDEO INPUT FROM VIDICON
VIDICON SIG. LOAD RES
MEASURE TARGET VOLTAGE HERE. TYPICAL VALUE IS 10-15 V.
TARGET ADJ
1N34
75Ω VIDEO OUTPUT
4700
6800
+125V
VIDEO AMP'S.
.4V 30~
.4V 7875~
MEASURE WITH BEAM OFF.
VERT SYNC IN
HORIZ SYNC IN



+280V
VERT SYNC TO PIN 7 OF 6UBA
680K
C_D
.1
APROX 10V FOR FULL SWEEP 30~ USE LOW CAPACITY PROBE.
+125V
150V 30~
120VAC INPUT FROM PWR XFMR
100V 30~
40V. 30~
.1
2.2 M
.165V ACROSS 10Ω RESISTOR TEMPORARILY PUT IN CIRCUIT.
30~
33K
.01
.05
6
7
6DE7
8
2
500K
9
VERT. DEFL. COILS
22K
D_C
100 K
4.7 M
2200
10V 30~
HEIGHT ADJ.
270K
VERT CENTER ADJ.
50K
.65V 30~
1800 2W
40MF 150V
12K
2.5K
100V. 30~
VERT. LIN. ADJ.
4V 30~
VERT BLANKING TO PIN 7 OF VIDICON
VERT. DEFL.



+125V
+280V
1200* 2W
250V 7875~
1K 2W
22K
6DE7
FOCUS COIL
.0033
.001
20MF 150V
3V. 7875~ ACROSS THE 39Ω RESISTOR
+125V
6
.001
1
1K
7
8
2
9
33K
2.2 M
HORIZ. CENTER ADJ.
33K
10-50MH
50K
HORIZ. LIN. ADJ.
75V 7875~
39
HORIZ. DEFL. COILS
50K
.005
8200
.01
5-25MH
15K
.5
680
.4V 7875~
HORZ FREQ. ADJ. RESONANT AT 15,750 CPS
75V 7875~
HORIZ. DEFL.
WIDTH ADJ 5-25MH.
HORIZ. SYNC TO PIN 7 OF 6UBA
40V 7875~
HORIZ BLANKING TO PIN 2 OF VIDICON

AN ELEEMOSYNARY VIDICON CAMERA FOR SCROUNGERS

PART III: Tuneup procedure

Mel Shadbolt, WØKYQ
Dakota City, Nebr.

If you've ever studied any courses on statistics and probability you are aware of the odds of hitting the correct combination of adjustments on any live camera if approached in a purely haphazard manner! I shutter to think of the number of fellows who I know that have attempted this procedure. Sometimes they work for months without any degree of success!

If this appeals to you I can wholeheartedly recommend that you read no further. On the other hand, if your like me, I'm sure you'll gladly set down and spend 10 minutes or so studying over the step-bystep procedure given on the next few pages. If you will, there is no reason why you can't be televising pictures before the evening is over ...assuming of course that you don't have too many wiring errors or bum parts.

PRELIMINARY CHECKS: Assuming you have already checked all resistances, voltages and sync-blanking waveforms as given in Part II you are about ready to start the tuneup procedure.

Begin by setting all adjustments to the position shown in TABLE I above.

ADJUSTMENT	POSITION
Frequency adj slug	minimum inductance
Width adj slug	minimum inductance
Horizontal linearity pot	mid-range
Vertical linearity pot	mid-range
Vertical height pot	mid-range
Smear adj pot	mid-range
Vertical centering pot	mid-range
Horizontal centering pot	mid-range
Electrical focus pot	set between 70-125 volts
Target pot	set for about 20 volts
Beam pot	set for maximum negative voltage

TABLE I PRELIMINARY SETTING OF ALL CAMERA ADJUSTMENTS

WARNING: NEVER TURN UP THE BEAM (less neg. voltage) UNTIL YOU ARE CERTAIN YOU HAVE BOTH VERT AND HORIZ SWEEP!!! IT COULD RESULT IN DAMAGE TO THE VIDICON. ALWAYS WARM CAMERAUP WITH THE BEAM OFF.

THE TUNEUP:

1. Prepare a simple test card as shown below in fig. 1. Don't use any complicated patterns to start with...this test card was purposely designed to be as plain as possible. Even then, you'll be very lucky if you can recognize it when you first turn your camera on. There's plenty of time for the more complicated test patterns once an image has been obtained.

2. Position the camera, light and test card as shown in fig. 2. Connect camera to monitor

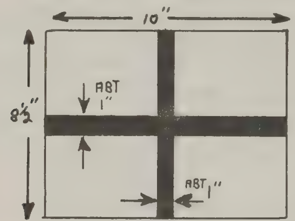


Fig. 1 INITIAL SETUP CHART Used for first time only to obtain image when both optical and electrical focus are way off. Can also be used for non-critical quadrature alignment of deflection coils.

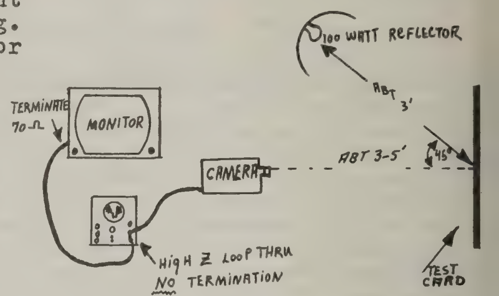


Fig. 2 BLOCK DIAGRAM showing arrangement of camera, lighting, slide and monitor. NOTE: Scope is not terminated.

and scope. NOTE: Camera must be terminated before it will work. Monitor should be set very near the correct vertical and horizontal scanning freq. prior to feeding the camera signal to it. This can best be done by checking it out on a local broadcast station.

3. Apply power to both the monitor and the camera and allow 3-5 minutes for warmup.

4. Begin adjusting the horiz frequency slug till the monitor locks horizontally. If the oscillator seems erratic and your unable to lock it to the monitor try varying the linearity pot slightly. It's in the plate circuit of the osc and if too far one way or the other can cause the osc to become erratic...especially when the horiz freq adj is quite aways off frequency. This is a normal characteristic of this type sweep circuit.....a variation of which is used in a great many CCTV cameras. Once correctly set it will be no problem.

No adjustment is needed on the vertical sweep since it is derived directly from the 60cps power line.

WARNING: If there is any doubt at this point whether or not you have sweep refer back to Part I and II for details on inserting resistors in series with the yoke leads and measuring with a scope for correct p-p waveforms.

5. Uncap the lens and set between F4.5 and F8.

6. Advance beam slowly until a "wiping" effect occurs across the screen. Don't be surprised

at what you see on the screen!

7. Take you hand and wave it back and forth directly in front of the test card. You should see a poorly focused shadow ofyour handmove across the screen. (Itmay move sideways or even up and down... this is caused by misorientation of the yoke...a problem not to be concerned about at this point.) Next wave your hand up and down and see if a shadow can be detected moving across the screen inthe other direction. If so, all is well ...your doing great! We now know you have vertical and horizontal sweep, a live vidicon tube and six amplifiers which are actually amplifying. SEHR GUT!! Let's continue.

8. Two things are of immediate concern:

(1) optical focus

(2) electrical focus

Let's tackle the electrical focus first. Since we don't know if the optical focus is anywheres near correct we can not expect to see an image merely by adjusting the electrical focus through its range. You will not see an image until both optical and electrical focus are nearly correct. Therefore we are forced to make the preliminary electrical focus adjustment using a slightly different approach. As you are probably aware, most vidicons have a few small blemishes on the surface of the target. This is true even in better grades of vidicons. These blemishes appear as small white spots on the viewing screen. Therefore all that is necessary is to adjust the focus pot thru its range until these little spots appear sharply in focus. This will be close enough for the time being.

9. Next adjust the optical focus till the cross is as sharp as possible. Now go back and double check the electrical focus. If you can see a well defined cross at this point your well over the hump....it shouldn't be long now before you are televising top notch pictures.

NOTE: Don't be concerned that the picture seems to rock as you adjust the focus. This is a normal characteristic of all standard vidicons used in B-W TV.

10. Now that you have obtained an image you should check to make certain the electrical focus is operating in the correct mode. It will focus at several different points..the correct one being the one that occurs at the highest voltage point.

ALTERNATE PRELIMINARY FOCUSING METHOD: Determine with the aid of a ground glass the exact distance from the glass to the back of the lens when focused on an object of the desired distance (3-5 feet in this case). Then set the lens this distance from the front of the vidicon. This will get you close enough that you should be able to recognize an image as you adj the focus control through its range. Once you have found the correct position for this control then you can touch up the optical focus for sharpest picture.

11. At this point you can further adjust the lens iris and target voltage for the proper video level. See fig. 3.

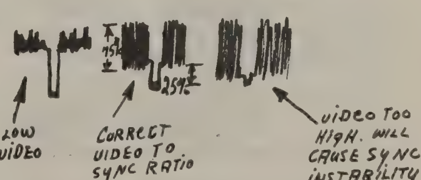


Fig. 3

12. If the picture is tilted, rotate the yoke until it appears straight on the monitor.

13. If the picture is upside down and/or inside ourreverse the polarity of the yoke leads.

14. Adjust the centering controls (both vert and horiz) until properly centered. See fig. 4.

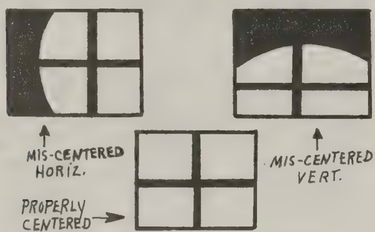


Fig. 4

15. Now transfer to a standard test pattern and adjust vert height and linearity the same as you would on a TV receiver.

16. Next adjust horizontal width and linearity in the same manner.

NOTE: Width and height adjustments may not give enough range. If this is the case vary the value of the 1200 ohm resistor in series with the focus coil until you achieve the desired size. This change will naturally require a slight correction of the electrical focus.

17. Adjust the smear correction pot for minimum trailing blacks or whites following large contrasty objects.

18. For optimum results go back now and recheck each adjustment very carefully.

This concludes the tuneup. See fig. 5 for a couple typical off-the-monitor pictures.

VIDICON TUBES HAVE A NORMAL LIFE EXPECTANCY OF 10 to 20 THOUSAND HOURS IF PROPERLY HANDLED. SOME HELPFUL "DON'TS" ARE LISTED BELOW.

VIDICON USERS, **DON'T**

1. Operate or ship tube in vertical position with faceplate down.

2. Underscan target.

3. Increase target voltage any higher than required for good picture. (Too high setting is characterized by poor background shading.)

4. Change scanning size & centering controls (or rotate tube) once the scanned area of the target has been properly positioned. (Old raster will show.)

5. Turn up beam without normal scanning.

6. Allow an image from any extremely bright sources (such as arc lamps or sun) to ever be focused on the target.

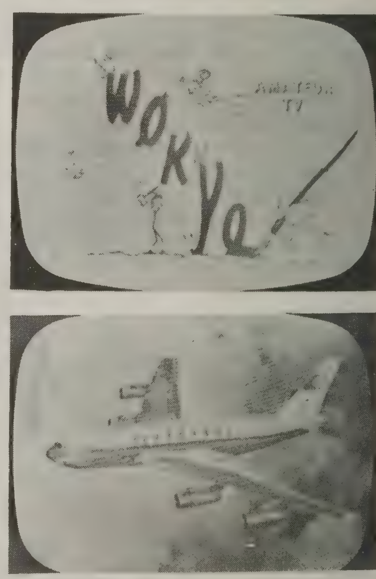
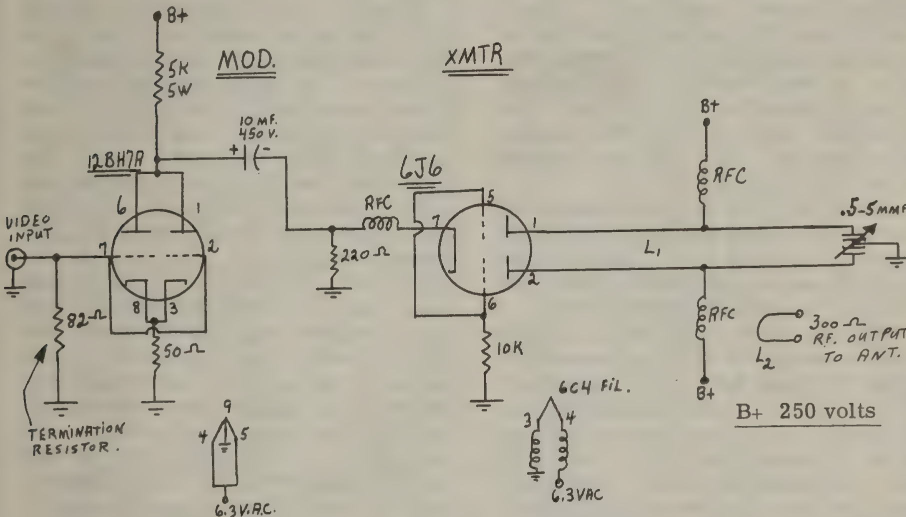


Fig. 5 Quality to be expected from Eleemosynary vidicon camera.

QUICK & EASY ATV XMTR!!!

An ideal beginner's transmitter. Feed output of your camera directly to this rig, connect ant and presto...your on the air.

Ralph E. Taggart, WA2EMC
Box 287
West Milford, N.J.



Our first venture in Ham TV was the camera/transmitter unit designed by W2VCG. This rig got us building ATV gear, but the video amp left a lot to be desired, so the next project was a camera along the line of WØKYQ's rig in <u>HAM TV</u>. Once the unit was completed, we looked for a quick way to get on the air without building a complex video modulator. The basic simplicity of W2VCG's modulation scheme was an attraction which led to the present circuit.

A single 6J6 is used as a self-excited oscillator which is modulated by a 12BH7A. The oscillator is straightforward and should cause no difficulty. L_1 is #18 wire, 4.5 inches long spaced 3/8".

L2 is a loop of #18 (insulated) used to couple the tank circuit to a 300 ohm transmission line.

The RFC chokes are #22 enameled wire, 12 turns on any 1/2 watt high value resistor. The correct tap point for the plate voltage can be found by temporarily connecting the chokes to the tank circuit and running the point of a lead pencil along the lines until a point is found that has the <u>least</u> effect on transmitter output. The chokes should be soldered at this point.

This little rig won't break any TV DX records, but it has performed nicely over several miles of hilly North Jersey terrain. It requires only a handful of parts and should serve as a nice initial low powered rig with no sacrifice in picture quality.

OFF-THE-AIR PULSE GENERATOR

WANT AN NTSC SYNC PULSE?? WHY NOT EXTRACT IT FROM YOUR LOCAL TV STATION??

Karl Grolla.
106 Male Ave.
Syracuse, N.Y.

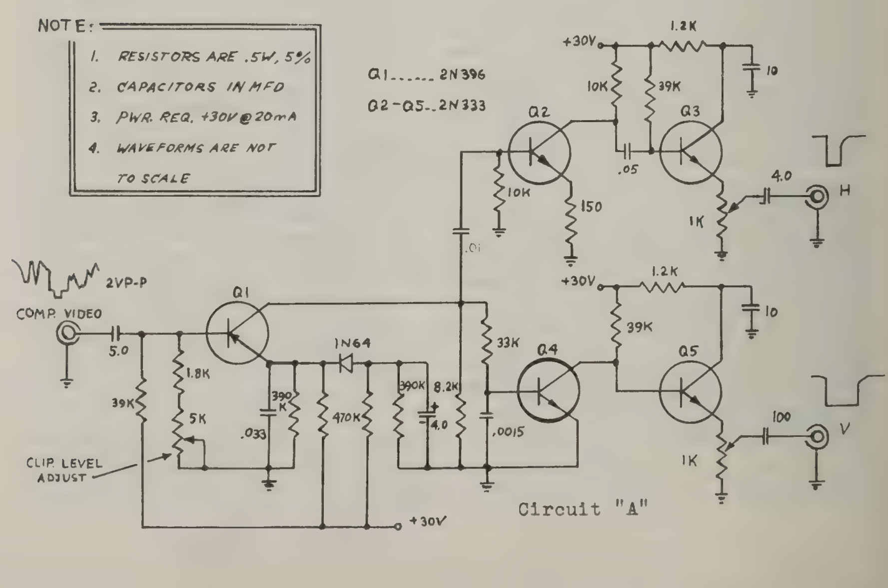
Sync signals are necessary for proper operation of TV cameras, flying spot scanners, etc. Some cameras using the non-interlaced principle of scanning have a built-in horizontal pulse generator, while the vertical sync is established by clipping the 60 cps sine wave.

Most of the better cameras are interlaced and use external pulse generators. These generators are expensive, even as "do-it-yourself" projects.

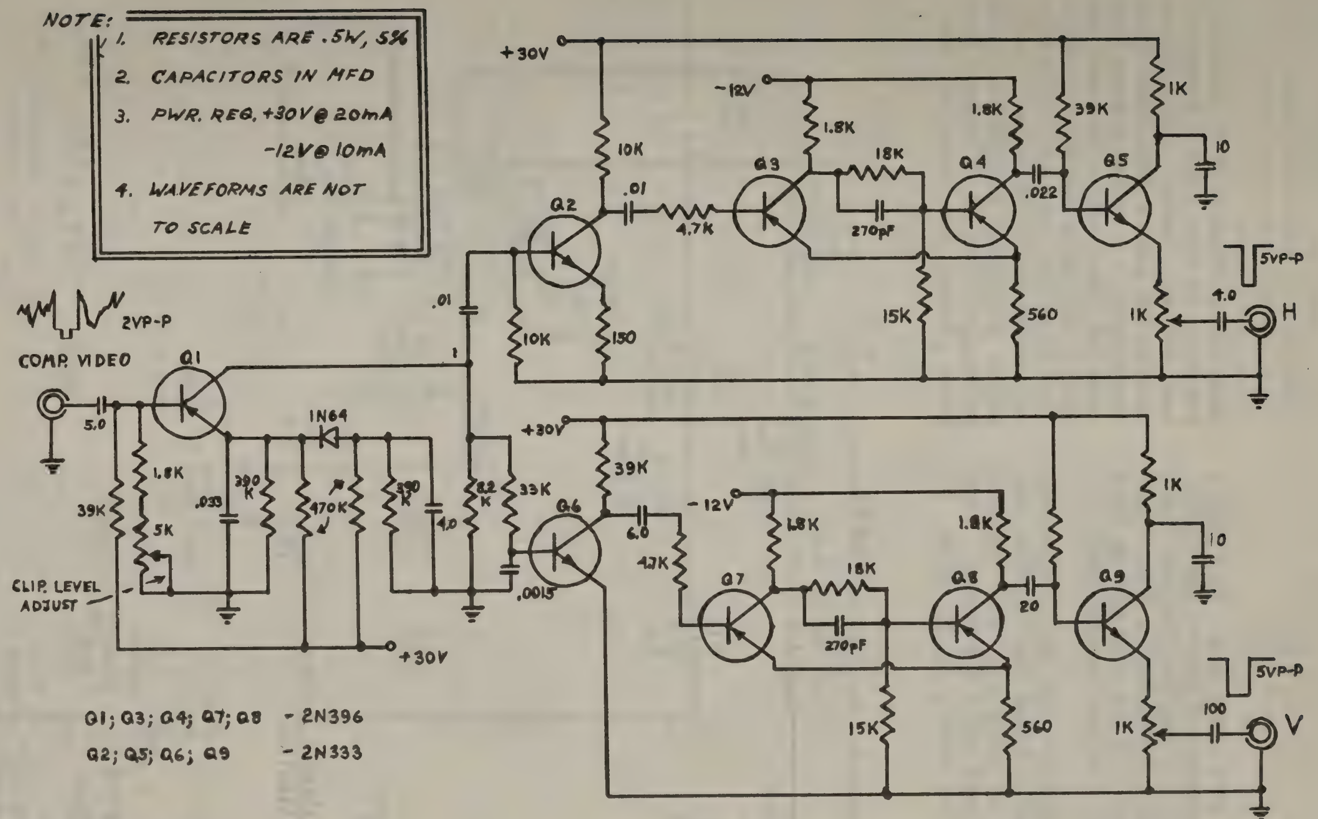
The two circuits given in this article make use of the composite video signal from your nearest TV station. These circuits, connected to the video detector of a TV receiver, will provide the horizontal and vertical sync pulses for your equipment, acting as the main pulse source or as a standby unit for emergencies.

Circuit "A" employs a 2N396 (Q1) as sync separator with a dual time constant in the emitter circuit. Q2 acts as an amplifier-inverter, and Q3 is an emitter-follower for the horizontal sync pulses. The vertical amplifier-inverter and low impedance output stages are composed of Q4 and Q5, respectively.

Circuit "B" is basically the same as "A". Where flat-topped sync pulses and good rise and fall times are required, the Schmidt trigger, inserted between the amplifier—inverter and the emitter follower, is adequate. (In circuit "B" this is Q3 and Q4 for horizontal and Q7 and Q8 for vertical.) Compare waveforms of "A" and "B".



Circuit "A"


NOTE:
1. RESISTORS ARE .5W, 5%
2. CAPACITORS IN MFD
3. PWR. REG. +30V @ 20mA
-12V @ 10mA
4. WAVEFORMS ARE NOT
TO SCALE
2VP-P
COMP. VIDEO
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
+30V
-12V
1N64
CLIP. LEVEL ADJUST
5VP-P
H
V
Q1; Q3; Q4; Q7; Q8 - 2N396
Q2; Q5; Q6; Q9 - 2N333

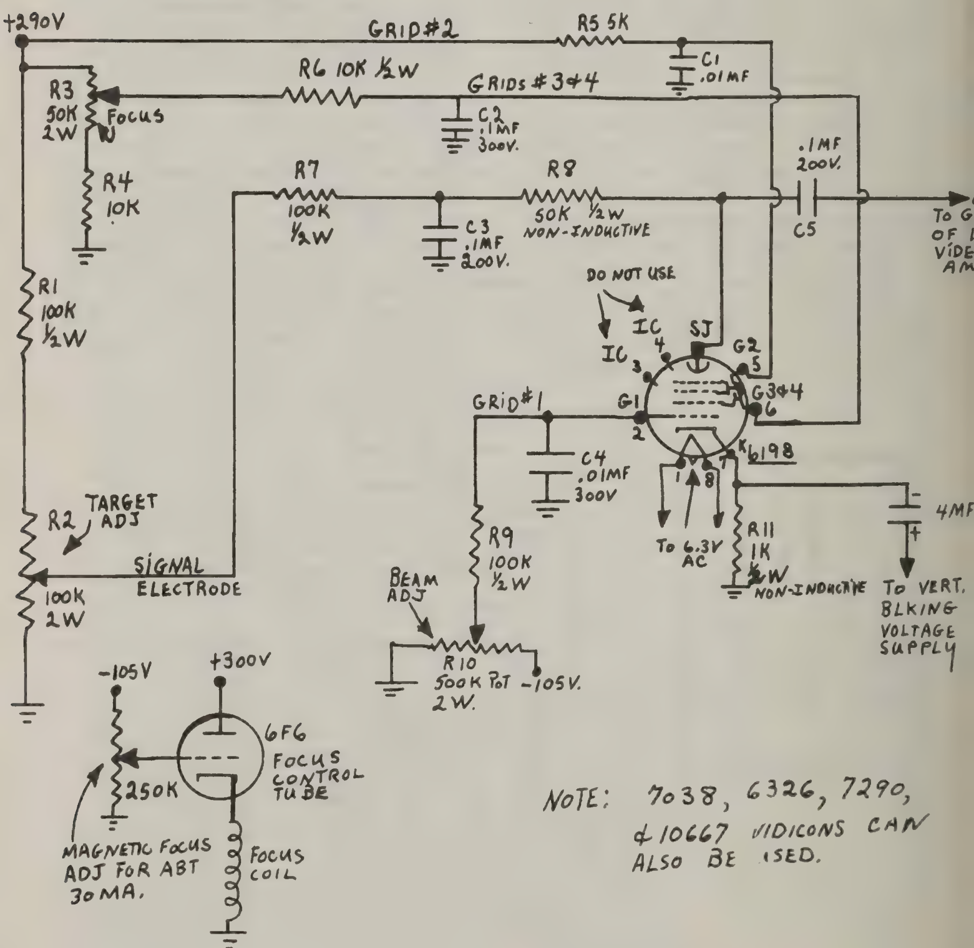
CIRCUIT B

CONVERTING THE ATK/ATJ ICONOSCOPE TO A VIDICON CAMERA

Pete Donneau, W1YIX
Manville, Rhode Island.
via K7VQI, Tuscon, Ariz.

Burnt out your ike or tired of running up your light bill trying to get sufficient light to properly operate your ATK camera? If so why not modify it for vidicon operation?

PROCEDURE: The deflection coil presently used for the ike can still be used for the vidicon. The focus coil is wound over it. Use about 1¼ lb of no. 30 enamelled wire. See winding details in the June issue of Radio-Electronics. Resistance should be about 385 ohms when completed. I made a form the size of the deflection coil and wound the wire on it. Make the form so you can slide the existing deflection coil in it after you have completed the winding. You will have to remove clamps and unsolder the



NOTE: 7038, 6326, 7290, & 10667 VIDICONS CAN ALSO BE USED.

shield from the front of the camera so as to lengthen the deflection cable because you will have to turn the coil to mount it on top and the leads will have to come from the rear of the vidicon.

Remove the high voltage used for the ike and not required for the vidicon.

Replace the 6X5 HV rectifier with a 6F6 focus control tube. Rewire as shown in the diagram.

You can remove all the following components, C111, 108, and 109, R109, 125, K7, 112 R110, 107.

Change R111 to 50K 2W..this is R3 on the diagram. Change R108 to 500K 2W...this is R10 on the diagram.

Remove R106 para control and use this hole to mount the new focus control, Remove R123 to make room for signal electrode control, 100K 2W.

LENS CHANGES: I used an old wide angle lens removed from an old 16mm movie camera. The present lens is far too large for the vidicon. You may be able to obtain a cheap uncoated 16mm lens for a few dollars at your local camera shop.

I made a flange the size of the flange on the big lens... with a hole in the middle for the 16mm lens and mounting screws.

Mount the vidicon so it will line up with the lens.

ADJUSTMENT: Setup procedure is the same as any other vidicon camera. If you are not familiar with this procedure it's suggested you read the material given in Parker's article in the June '62 Radio-Electronics magazine.

****

NEXT DEADLINE: July 1st!!!

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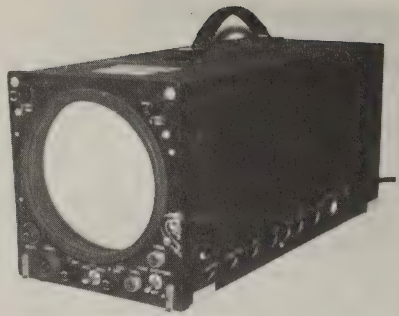
FIVE MINUTE VIDICON MODIFICATION

Jim Kennedy, K6MIO
2816 E. Norwich
Fresno 26, Calif.

Many people who have procured vidicons from broadcast television stations will find that they have obtained 6326's. This RCA vidicon is commonly used for film pickup of both black and white and color. Because of the fact that it is commonly used in 3V color film cameras, the focus anode has been split into two sections and is brought out on two pins at the base rather than on one. These are pins 3 and 6. This is done because of a special type of extremely fine electronic focusing called dynamic focusing which is used in color applications to insure perfect matching of the three vidicon tubes employed in a color camera. In amateur applications it is desirable to employ conventional electronic focusing when using this tube. In order to do this pin 3 and pin 6 should be tied together. It will be noted that in the more conventional one inch vidicons (6198, 7038, 7735, etc.) the focus anode is brought out to pin 6. By merely supplying your vidicon socket with a jumper between pin 6 and pin 3, the 6326 may be used. Despite the fact that tube specs on the more conventional tubes generally indicate an internal connection for pin 3, it has been found that in all tubes observed here, no such connection exists, though the pin may have been utilized in the getter circuit when it was originally manufactured. This being the case the added jumper should in no way interfere with the operation of tubes other than the 6326, and it is known that at least one manufacturer of broadcast type cameras incorporates this jumper into its camera systems as a matter of policy.



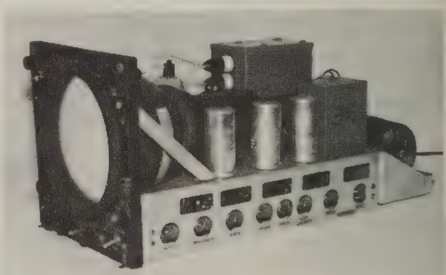
SURPLUS VIDEO MONITOR

Bruce Robinson VE9OX
297 Yonge St.
Kingston, Ont.,
Canada.

The ID-66/AXR-1* is a well constructed video monitor that was designed to accompany the better known ATK/BC-1211 Ike camera. Packed into its 8"x 9"x18" case are a two stage video amplifier, sync amplifier and separator, vertical and horizontal deflection circuits, a high voltage supply, C.R.T. and dynamotor. Since its schematic does not appear to be readily obtainable, it is repeated here in full.

CIRCUIT DESCRIPTION: The video amplifier uses a 6SN7 with shunt peaking. (See figure 1.) The common cathode resistor is very heavily bypassed, but oscillations are possible if C 602a goes flat. A 200 ohm contrast control is included. Since its value is too high to properly terminate a 75 ohm line, the SO239 input socket should be bridged with 120 ohms. Alternately, increasing the value of the pot would permit the "looping through" of the video signal. Since the C.R.T. is not internally blanked, the video signal must be properly blanked, or retrace lines will be visible.

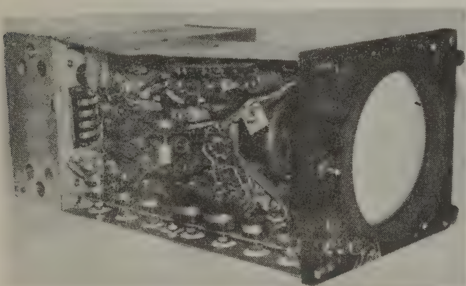
As shown in figure 1, the sync amplifier, separator, vertical oscillator and output stages are conventional and include height and vertical linearity controls. The sync amplifier's grid resistor is perhaps too small to permit "looping through" of the sync pulses, but it can easily be changed. Resistive damping is used on the primary of the vertical output transformer.



The horizontal deflection circuit incorporates some unorthodox designs. The C.R.T. bias is taken from a resistor string that also feeds the horizontal oscillator, and the

accelerator grid voltage is also the screen voltage of the horizontal output tube, an 807. There is no damper tube. Since the plate impedance of the 807 is too high to provide adequate damping alone, a "tuned retrace" is used. This is provided by the adjustable resistor and 0.03 mfd, condenser in series, across the horizontal coils.

The time constant of this network is adjusted to match that of the yoke. This technique, used extensively before the war, has since been replaced by much more efficient circuits using damper tubes.



Centering is provided by passing a DC current of adjustable magnitude and polarity through the deflection yoke.

The only serious objection to this monitor is the cathode ray tube itself...a 7CP1 which has a <u>green</u> phosphor. It will take up to 7700 volts, requires 55 degree deflection, and is electrostatically focused. The bulb is exactly 7" in diameter; the neck is 1.37" diameter; the socket is an octal, and the tube is 13.4" long overall. A potential substitute for the 7CP1 is a 7DP4. It is a 50 degree deflection tube, similar to the 7CP1 except that it is about ½" longer and requires a duodecal 7 pin base. Unfortunately, its neck diameter is 1.44" ± 0.06", whereas the 7CP1 is 1.37" ± 0.06".

This might present a problem as the hole diameter of the deflection yoke is approximately 1.44" also. A bit of phenolic filing should cure the matter. In case you're interested, the base connections of the 7DP4 are: Pin 1 heater; Pin 2 Control grid; Pin 6 focusing anode; Pin 7 internal connection; Pin 10 accelerator grid; Pin 11 cathode; Pin 12 heater.

If all this bothers you maybe you can locate a surplus 7CP4...a direct replacement for the 7CP1...except it has a white phosphor.

CONVERSION: With 6SN7GTA's substituted for the two 12SN7GT's, and all filaments wired in parallel, 6.3 volts at 2.7 amps is required. The 43 and 63 ohm resistors are removed. 400 volts at about 100 ma. will be needed for the high voltage, although care should be taken to reform the plates on the electrolytic condensers before 400 volts is applied. Probably the easiest way to supply the centering voltage is from a filament transformer, via a full wave selenium or other rectifier.

The AXR monitor is built to a very high mechanical standard as shown by the pictures. The transformers are all of the sealed variety, and the deflection circuit design appears to be very conservatively rated. The unit is quite compact when compared to a regular TV set.

A very convenient feature of this monitor is the separate input sync jack. This makes it possible to feed video and sync to the monitor separately for the purpose of monitoring non-composite video signals. Anyone know of a supply 7DP4's or 7CP4's...cheap??

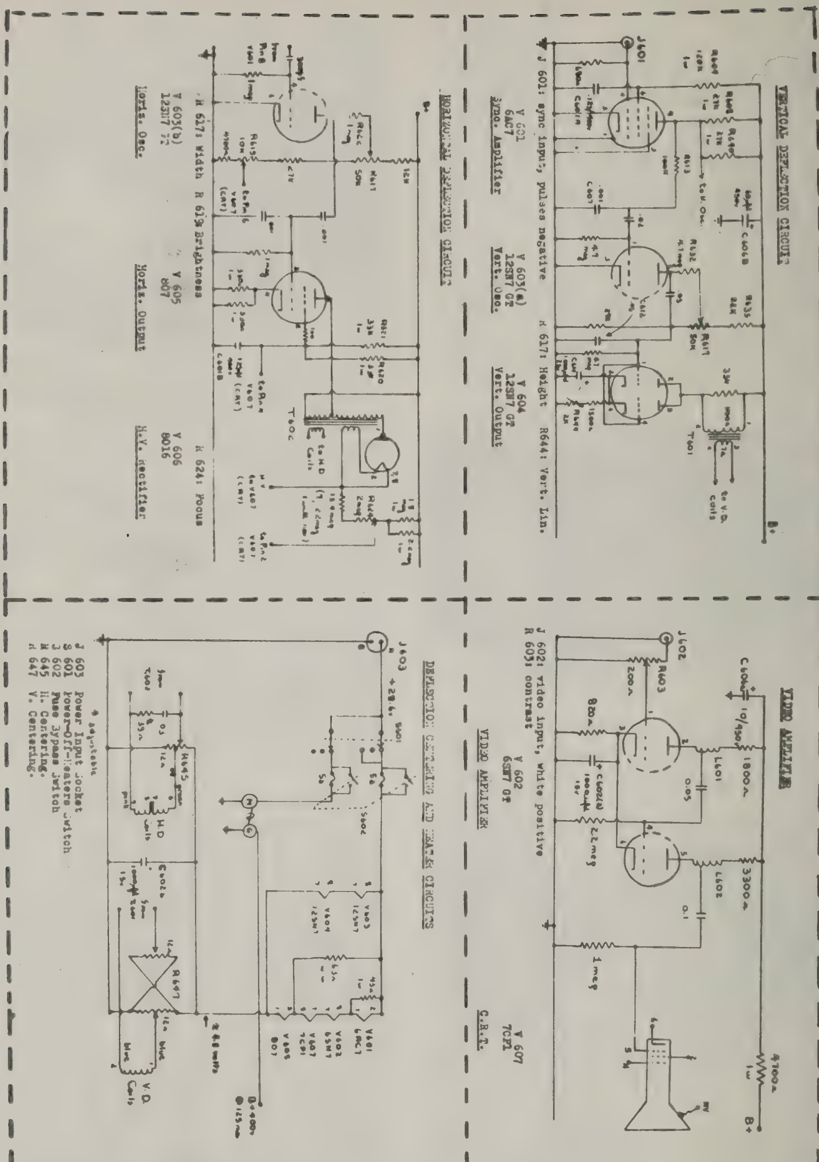
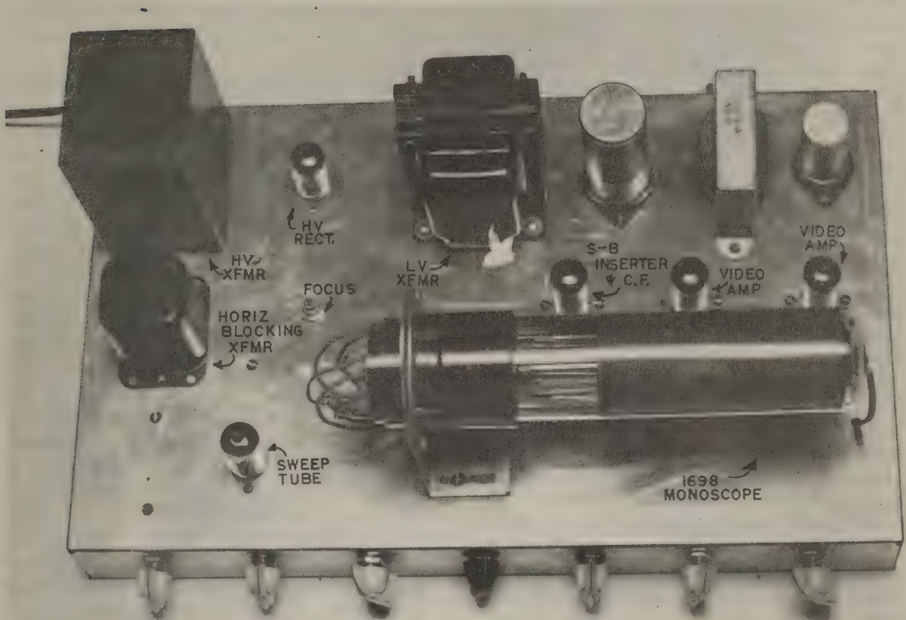


Fig. 1 Complete schematic of the ID-66/AXR-1 video monitor.

A MONOSCOPE CAMERA

W∅KYQ

A video test generator specifically designed for thin pocketbooks...simple yet effective.



Have you ever sat at the work-bench for hours on end running final checks on a newly constructed piece of ATV gear and found yourself in dire need of a fixed video test signal? Probably so, and if your like the rest of us quite likely you got out the vidicon camera or flying spot scanner and used it to generate the pattern. Without doubt, this works very well but oh what a way to whittle the life out of that highly cherished pickup tube (or CRT in the case of the FSS).

How much more practical this job could have been accomplished with the aid of a monoscope camera.

Even though this type camera has always created interest among ATV'ers for purposes of generating fixed test patterns, its cost until recently has been prohibitive.

CONSTRUCTION: Fig. 1 shows a complete schematic of a simple, yet effective monoscope camera. All resistors are ½ watt and capacitors are in MFD unless otherwise stated. Component values not shown on the schematic are given in the parts list at the end of the article.

Layout is not critical if several things are kept in mind. (1) Mount the monoscope such that the lead from the signal cap down to the grid of the first

video amp is no longer than 6 inches. Use low capacity shielded cable for this job. (2) Keep all transformers and chokes as far from the 1698 as possible to prevent undue beam distortions. If possible use a mu-metal shielding over the tube...this will further protect against stray magnetic fields including the earth's field. (3) Use an electrostatic shield over the signal plate portion of the tube to prevent stray RF pickups such as those caused by nearby AM broadcast stations.

The entire unit can easily be constructed on an 11 x 17 inch chassis. A photo showing the parts layout in our original unit is shown on the front cover. This arrangement proved to be quite adequate except that we would recommend anyone duplicating it to place the low voltage power transformer more to the left rear, since in the location shown its magnetic field effects the monoscope beam with the mu-metal shield removed.

OPERATION: The minute current variations developed across the signal load resistor (470K grid resistor in first amp) are sufficiently amplified by a four stage video amplifier; the first three stages of which incorporate negative feedback to offset the capacity losses from the signal plate and signal lead to ground. The amplified signal is coupled to the 75 ohm line through the cathode follower, V3a. Sync-blanking pulses are mixed with the video in the cathode circuit of V2b.

Note that the cathode of the 1698 is operated about 800 V above ground. Therefore the filament must also be operated above ground from a separate winding.

Vertical sweep is obtained through a discharge stage, V4a locked to the AC line through a waveshaping and clipping network.

Horizontal sweep is obtained from a blocking oscillator, V4b.

The combination sync-blanking pulse developed across the resistor in the discharge network of each deflection amp is mixed, clipped and inserted in the fourth video amp by the sync-blanking inserter, V3b.

Focusing, beam current adjustment and centering controls are all conventional similar to those used in most scope circuits. The two power supplies are also quite straightforward and should require no explanation...just one thing, it will be noticed that we have +300 and a -175 instead of a single +475. The reason being, 300 volts was desired for the video amps and sync inserter but the additional voltage was advantageous for improved sweep linearity. Voltage dropping resistors could have been used but we liked the fact that this allowed us to use readily available lower voltage capacitors both in the power supply and also in the coupling and discharge networks. The method you choose will depend on your own personal preference.

TUNE UP: Assuming no wiring errors or defective components, checkout procedure is relatively simple compared to a flying spot or vidicon. Being an electrostatic type tube it's merely a matter of correctly setting the adjustment pots. Proceed in the following manner:

(1) Set all knobs except the beam (which should be set for maximum bias) to mid-range.

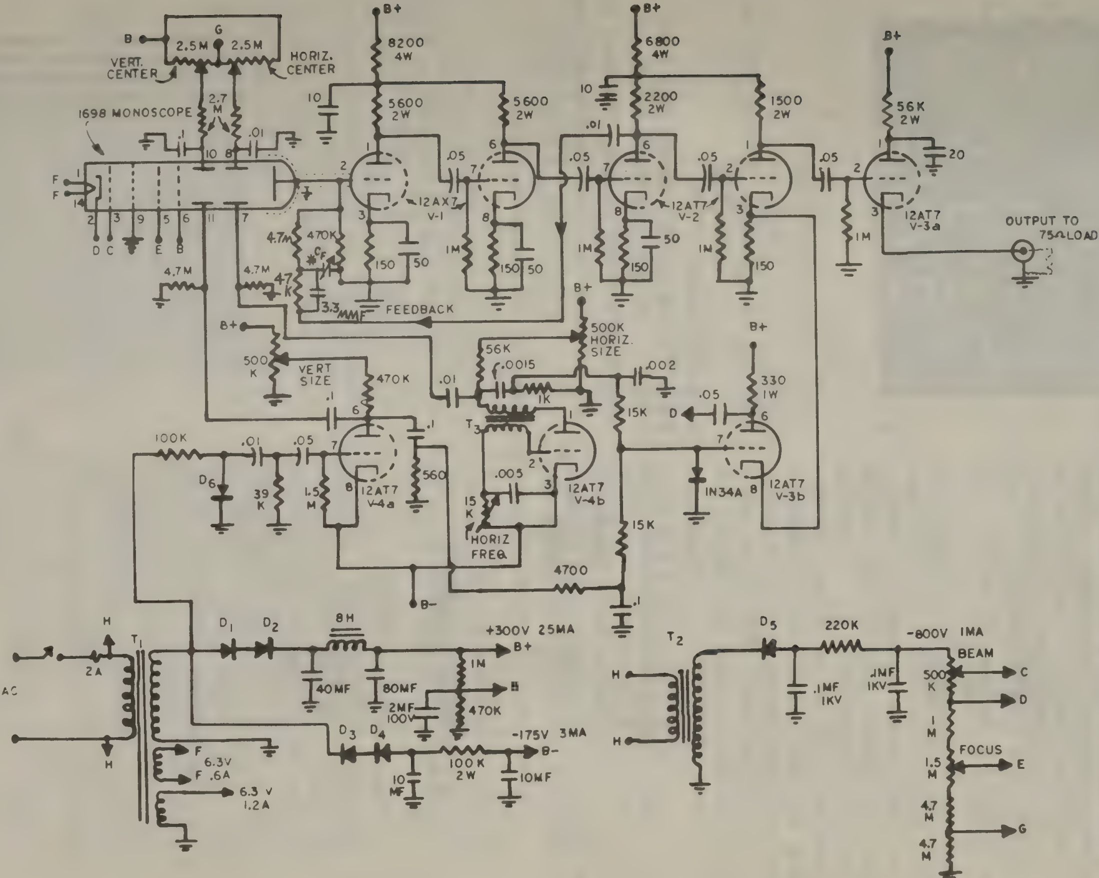


Fig. 1 Schematic of monoscope camera.

*C_f is a 4-40mmfd compression trimmer. The sizes of the 47K and 3.3mmfd (in the feedback loop) can be altered if elimination of smear cannot be obtained within the range of C_f. Variations in individual wiring practices frequently result in such out of range situations. However, careful wiring using standard video amp practices should prevent this.

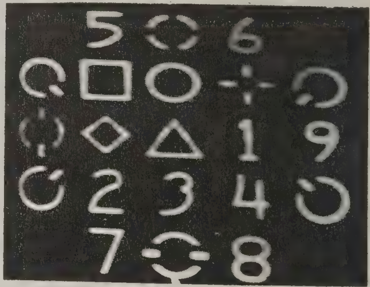
(2) Check to make sure monitor is properly adjusted on a local station prior to feeding video to it. (Be sure it's properly terminated.)

(3) Now apply power and allow about 2 minutes for stabilization. The monitor should now be locked vertically since the vertical sweep is derived from the 60 CPS line. The horizontal osc is free running and unless you were lucky will probably not be on frequency. If this is the case, adjust the frequency pot in the camera till the monitor is properly locked.

(4) Your now ready to see if you can get a pattern. Start advancing the beam control (lowering the grid bias). An image should immediately become visible. If so, continue bringing up the beam until a normal contrast picture is obtained. Now the centering, focus and size controls can be adjusted for best picture.

(5) The only thing remaining is to check the feedback in the video amplifiers. If you have either trailing whites or blacks following any of the areas on the pattern, feedback capacitor C_f is incorrectly set. Adjust it for minimum smear as observed on the monitor.

That's it...you now have a fixed video pattern generator. See fig. 2 for an off-the-monitor picture of the 1698 pattern.



Parts List

D_1-D_4, D_6-Silicon diodes, 200 ma 400 PIV
D_5-HV diode, 1500v
T_1-Power transformer, 300 v at 50 ma plus 2 fil windings
T_2-Scope transformer, 800 v at 1ma
T_3-Horizontal blocking transformer Thordarson TV-24190

LECHER LINES

Tom Bard, WA2MZL

If your in need of a lecher line why not construct one on a "give-away" yardstick backed up with a piece of plywood? The markings on the yardstick eliminate the necessity of any other measuring device. Simply record the points between two successive nodes and subtract the smaller from the larger. The frequency can then be determined by the following chart:

420mc-14.06 inches
425mc-13.89 inches
430mc-13.73 inches
435mc-13.57 inches
440mc-13.42 inches
445mc-13.27 inches
450mc-13.12 inches

For other frequencies use the following formula:

$$F = \frac{5905}{N_1 - N_2}$$

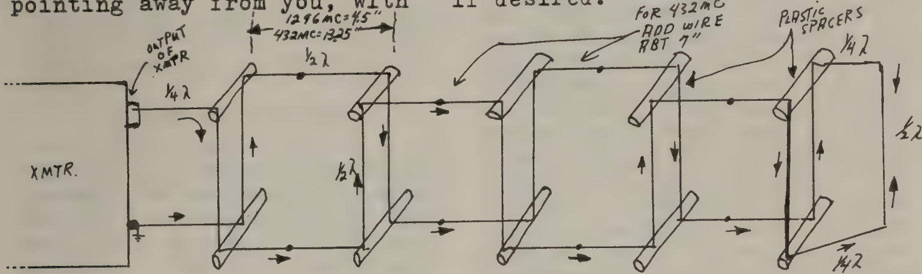
where F is frequency in mc and N_1-N_2 is inches between any two nodes.

STERBA ANTENNA

R. V. Frederick K4UGC
460 NW 108 Terrace
Miami, Florida

Here's a new way to build a Sterba Curtain Antenna for 420 mc using 300 ohm air spaced TV Transmission line. (The kind that has the insulators already built in at every 6 inches.

Cut both wires half way between the insulators so as to have (for instance) ten insulators for ten active elements. Place one insulator pointing away from you, with two 3 inch wires going up and and two 3 inch wires going down. Bend the nearest "going up" wire horizontally to your left. Bend the far "goingup" wire to you right...also horizontally. Do that to ten pieces then assemble as in the drawing below. Elements in the horizontal plane add while those in the vertical cancel. It can be extended to many more if desired.



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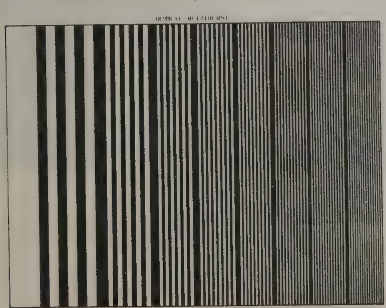
OPTICAL MULTIBURST

A new system for evaluating cameras.....by WØKYQ

Sometime back I drew up an optical multiburst chart like the one shown below. It is without doubt the most efficient and practical way of determining once and for all the <u>REAL TRUE</u> response of your vidicon camera. This is because it isn't like your electronic type sweep generators or multiburst generators in which only the amps themselves can be checked. On the contrary, this chart does all that PLUS it checks out the pickup tube and lens system also!



I dreamed up this idea about a year ago when I was getting ready to run final checks on one of my recently constructed cameras. It worked excellent! However, like many good ideas, it got thrown into an empty corner and forgotten. Forgotten until recently that is, when it was noted that a well known manufacturer came up with the same idea reporting it was far superior to test patterns since all subjective evaluation is eliminated.

We are now prepared to make photographic copies of our chart for anyone who would like one. The cost is: $1.00 for an 8 x 10 or $2.00 for 11 x 14. This includes postage. Send to WØKYQ, Box 453, Dakota City, Nebraska.

NEGATIVE FEEDBACK AMPLIFIERS

Thanks goes to the British Amateur Television Club for their permission to reprint this excellent article on negative feedback which originally appeared in #41 of their own publication, CQ-TV.

Amplifiers using negative feedback can achieve low distortion, good frequency response and gain stability unobtainable in any other way. It is therefore a little surprising that so many BATC members seem to be nervous of negative feedback, NFB for short. Let's creep up on it quietly, then. The basic idea of negative feedback is that if an amplifier stage distorts in the sense, say, of having too much gain at one particular frequency, more of that frequency appears at the output, more of it is fed back to the input, but in the negative sense, where it reduces the input signal at that frequency and tends to correct the error; in other words, it tends to flatten out unevenness in the frequency response.

The gain of an amplifier is of course reduced by feedback, but this is not necessarily a disadvantage (mere gain is easy to come by...it is securing the necessary bandwidth, linearity and low noise that is troublesome). If an amplifier has gain A, reduced by application of NFB to A', A and A' are related by the formula

$$A' = \frac{A}{1 + pA}$$

where a fraction 1/p of the output is fed back to the input. The output impedance of the amplifier is at the same time changed from Z without feedback to

$$\frac{Z}{1 + pA}$$

with feedback. This much can be found in most of the text-books (where I found it!) If the gain A of the amplifier

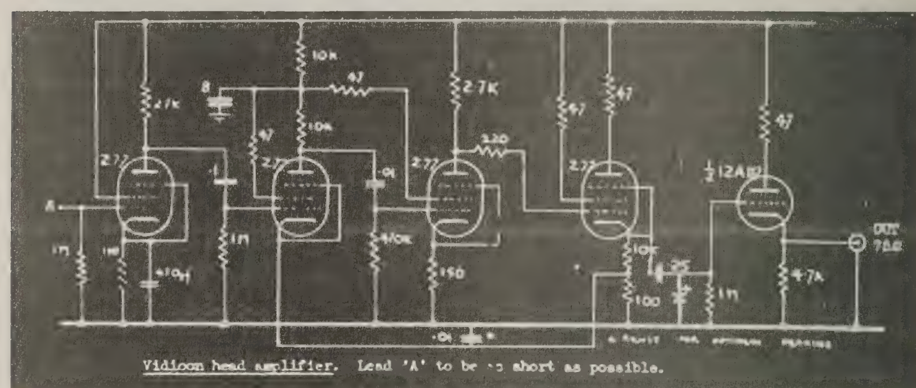


Fig. 1
Feedback loop is shown in this amplifier as being from cathode of forth stage back to the cathode of the second stage.

without feedback is large, then A'=1/p approximately...so the gain of such an amplifier may be determined merely by inspection of the component values in the feedback chain, and is independent of the stage gain.

Applying this to John Tanner's vidicon head amplifier (reproduced in fig. 1 as it appeared on the back cover of CQ-TV #36); the 2nd, 3rd and 4th Z77's have together a gain of 100, since the feedback, obtained from the cathode of the last Z77, is potted down in the ratio

$$P = \frac{100}{100 + 10{,}000} = \frac{1}{100} \text{ approx}$$

Hence the gain = 1/p = 100.

Now for a few practical considerations. To extend L.F. response, a capacitor of the order of 1 mfd may be included in the feedback chain. A typical circuit is shown in Fig. 2 inwhich feedback is applied

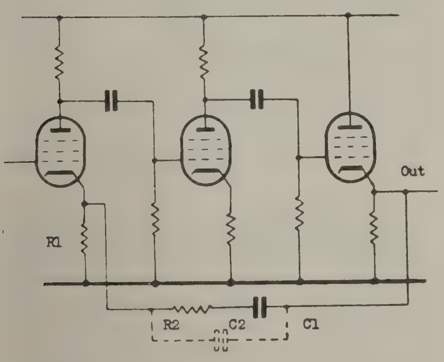


Fig. 2

from an output cathode follower to the cathode of an earlier stage; in this case, the gain 1/p will be

$$\frac{(R_1 + R_2)}{R_2}$$

at mid-frequencies; at low frequencies, the impedance of C_1 will be large, there will be less feedback, and the gain of the amplifier will be maintained down to lower frequencies. Some control over L.F. response is therefore available by choice of the correct values of C_1 and R_2. C_1 can conveniently be a cathode-decoupling type electrolytic, since the working voltage is generally low, and a little leakage doesn't matter very much...but make sure it's the right way round!

H.F. response can also be controlled by judicious use of NFB; a small capacitor of the order of a few mmfd across R_2 will apply more feedback at high than at mid-frequencies, tending to cause the frequency response to fall at high frequencies. If as more usually happens, a lift at H.F. is required, the feedback may be shorted to earth at H.F. by a small capacitor, best done by splitting R_2 in two, and putting a small C to earth from the mid-point, as in Fig. 3. Splitting R_2 so that C_2 is 1/3 of the way along may give better results.

For those members without a sweep generator (!), the best way to set up a frequency response is to look at the edges of a pulse. Pass, say, sync through the amplifier and look at the output on a decent scope; trim the amplifier for best rise and fall times and sharp corners to the line pulses, consistent with lack of overshoot and ringing. But be sure to look at the pulses first of all with the scope alone, and make sure you are not overpeaking the amplifier to correct for poor response in the scope.

A few words of warning now: NFB amplifiers have a bad name for their tendency to oscillate outside the pass band. This is deserved, alas, but can be prevented. NFB amplifiers will

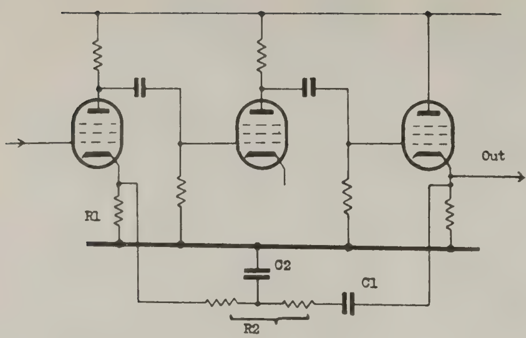


Fig. 3

oscillate (and how!) if the phase shift that accompanies falling H.F. or L.F. response approaches 180° for any frequency for which the gain of the amplifier as a whole exceeds one, for then the feedback becomes positive.

Practically, this can be avoided by not attempting to apply feedback over more than three stages at a time (the "ring of three" scheme consists of two gain stages and a cathode follower), and limiting it to about 30db of feedback at maximum. If this does not provide enough gain, cascade two or more of these discrete amps. Bear in mind too, that it is just not possible to get, say, 20db improvement in H.F. response from an amplifier that has a gain of only 18db without feedback. However, higher values of anode load can safely be used when feedback is applied, so the gain of the amplifier without feedback (the "internal gain") can be increased, and more feedback applied, so that the gain of the amplifier with NFB remains the same.

Finally, a word on fault finding in feedback amplifiers. This is very simple when you know the trick: put a signal into the amplifier and follow it through and round through the feedback loop back to the input. At some point, the distortion in the signal due to the fault will be reversed, since the feedback will be applied "all out" to correct it. For example, a coupling capacitor which has gone down in value will cause excessive L. F. tilt on a low frequency (50 or 60 cps) square wave passed through the unit. After the capacitor the signal will have positive tilt; before it, full feedback will be applied and the tilt will be negative. This enables the faulty component to be identified quickly. Similarly a valve* in the amplifier operated under wrong conditions so as to clip a sine wave will have peaks clipped at its anode, but greatly stretched at its grid.

*British term for tube.

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420 MC ATV ANTENNA NO PROBLEM

The passband of an antenna is largely determined by the ratio of element diameter to element length. The lower the the ratio, the broader the antenna.

Due to the extremely short element length (just slightly over 1 foot) when operating in the 420 mc band and due to the fact that the element material will have at least $\frac{1}{4}$-$\frac{1}{2}$ inch diameter, rarely will one find an antenna that does not have a very minimum bandpass of at least 4-10 mc. This makes almost any 420 mc antenna satisfactory for ATV without modification.

AURAL SUBCARRIER
—THEORY AND PRACTICE—

Here's one of several systems for transmitting the audio portion of your sig.

Jim Kennedy, K6MIO
2816 E. Norwich
Fresno, Calif.

One of the problems the ATV'er eventually runs into is the complication of aural communication. While a standard practice is to use existing ham gear for the transmission of the aural portion of the QSO, this has, under some conditions, serious drawbacks.

Consider for instance the difference in propagation work, it might be found that the 420 mc signal was coming through in great shape on trops but that the 50 mc aural signal was nowhere to be found.

Aside from this type of difficulty, separate carrier operation offers many practical inconveniences. It does require two separate transmitters and it requires that anyone you wish to work be set up to operate on the same band that you wish to send the audio on. This in itself can represent a formidible problem in DX and even local work.

SOLUTION: The simple solution to this problem is to transmit the aural portion of the QSO on an FM carrier 4.5 mc above the visual carrier in the same manner as commercial TV and use the TV set to recover the aural portion of the QSO as well as the visual portion.

In order to do this we have several choices. A separate FM transmitter could be built and also a diplexer or a separate antenna for the aural carrier. This system is used in commercial TV and is quite effective. It is also, however, quite expensive, and difficult to QSY. There are several other systems and variations, but probably the best compromise is the aural sub-carrier.

If an oscillator is constructed which operates on 4.5 mc, and the output from this oscillator is delivered to the video input of the visual xmtr modulator then the xmtr will produce sidebands both 4.5 mc above and below the visual carrier. If we disregard the sideband below the carrier and consider only the carrier and the upper 4.5 mc sideband we find that we have something that looks for all the world like two separate carriers 4.5 mc apart. At the receiving end there is no way to tell whether the two carriers we hear were produced by two separate transmitters, or by the carrier-sideband system. Now, if we were to modulate the frequency of the 4.5 mc oscillator we would find the 4.5 mc sideband would also be freqency modulated. If video is run into the modulator video sidebands will also appear.

Because we wish the 4.5 mc sideband to convey different information than the other sidebands (which are conveying video information) we distinguish it from the other sidebands by calling it a <u>subcarrier.</u> It performs the function of a carrier but is in fact itself the product of modulation and another carrier.

Hence it is seen that both visual and aural information can be generated in the same xmtr. A quick examination of the facts will show that such a system has several advantages

to the ATV'er. Only one transmitter is required, no modifications are required if the transmitter is properly designed, only one antenna is required, a diplexer is unnecessary and the ATV'er may QSY to his heart's content.

While we are considering the system's merits it is well we consider some of its limitations. As it is a product of modulation the amplitude of the sub-carrier is limited to 25% (power) of the visual carrier amplitude and, practically, less than this if we wish to transmit any video information. It is also necessary that the RF and video modulator bandpasses be sufficiently broad to pass a fair amount of 4.5 mc sideband into the antenna.

With these limitations in mind let us scrutinize the requirements of a typical subcarrier system.

Fig. 1 Standard Video Waveform

First of all, it is our primary desire to transmit video! ...so let's start there. In the United States it is commercial regulations that the standard system for video transmission have the sync level at 100%, the blanking level at 75% and the white level at 12.5%. See Fig. 1. (These percentages are, incidentally, with reference to voltage output not power. An oscilloscope connected to a diode probe coupled into the output transmission line will read this percentage directly.) It will be noticed in this system that the region between 12.5% and zero is not used for anything (except a guard region to avoid overmodulation).

If we choose to approximate this standard we will have a region between zero and 10 to 20% in which we may transmit our aural sub-carrier without sacrificing any of our video information.

In reality the information will be superimposed on top of the video information and the exact DC level of the sub-carrier will vary as the video DC level varies. If the white level is set at 12.5% then the sub-carrier may swing plus and minus 12.5% and it will never overmodulate. See Fig. 2. Such a setup will allow a 25% peak to peak sub-carrier level.

On-the-air tests have shown that such a sub-carrier level will produce good results under good signal conditions with most receivers. There are, however, some problems that may crop up under poor signal conditions with inter-carrier type receivers. The inter-carrier sets use the same IF strip for both aural and visual carriers and rely on the 4.5 mc beat between the two carriers to supply a 4.5 mc FM signal to the sound IF which is tuned to 4.5 mc. This results in both visual and aural information being presented to the video amplifier in the set. In order to prevent a herring bone pattern in the video caused by this beat the aural carrier is placed in a deep notch in the visual IF curve. The aural

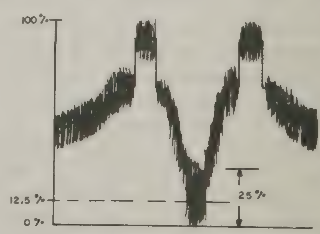


Fig. 2 Video Waveform with superimposed sub-carrier.

carrier is generally attenuated in the neighborhood of 20 to 30 db. When a commercial station with a separate aural transmitter is being received this presents no problem but when the aural level is already down 14 to 20 db as in the sub-carrier case a weak signal may have trouble squeezing through much aural carrier.

This condition may be readily rectified by obtaining a sweep generator and increasing the IF bandpass of your receiver so that the aural carrier is on the top of the curve instead of on the bottom. This 20 to 30 db rise in aural level will place the subcarrier level actually higher than a commercial carrier under normal circumstances. When this is done sub-carrier performance will equal or surpass that of commercial stations before the modification. It was also found that the beat problem was not serious when the set was tuned to a commercial station after the modification had been made. See figs. 3 and 4.

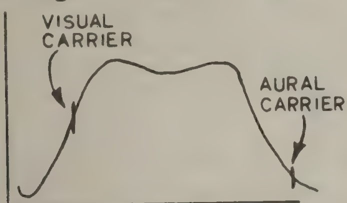


Fig. 3 Normal IF Response

Air tests have also revealed another interesting feature of the system. Due to the fact that most TV sets do not employ adequate limiting in the FM circuitry a fair amount of vertical sync buzz can be anticipated if the video information does not contain a serrated vertical sync pulse (a vertical pulse made up of a series of horizontal timed pulses). If, however, a serrated pulse can be supplied, then the situation is minimized and constitutes no problem.

Now to attack the second requirement of the system. Once the sub-carrier is generated,

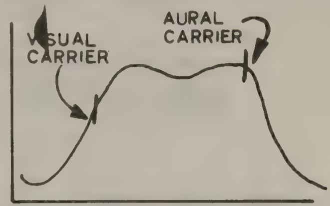


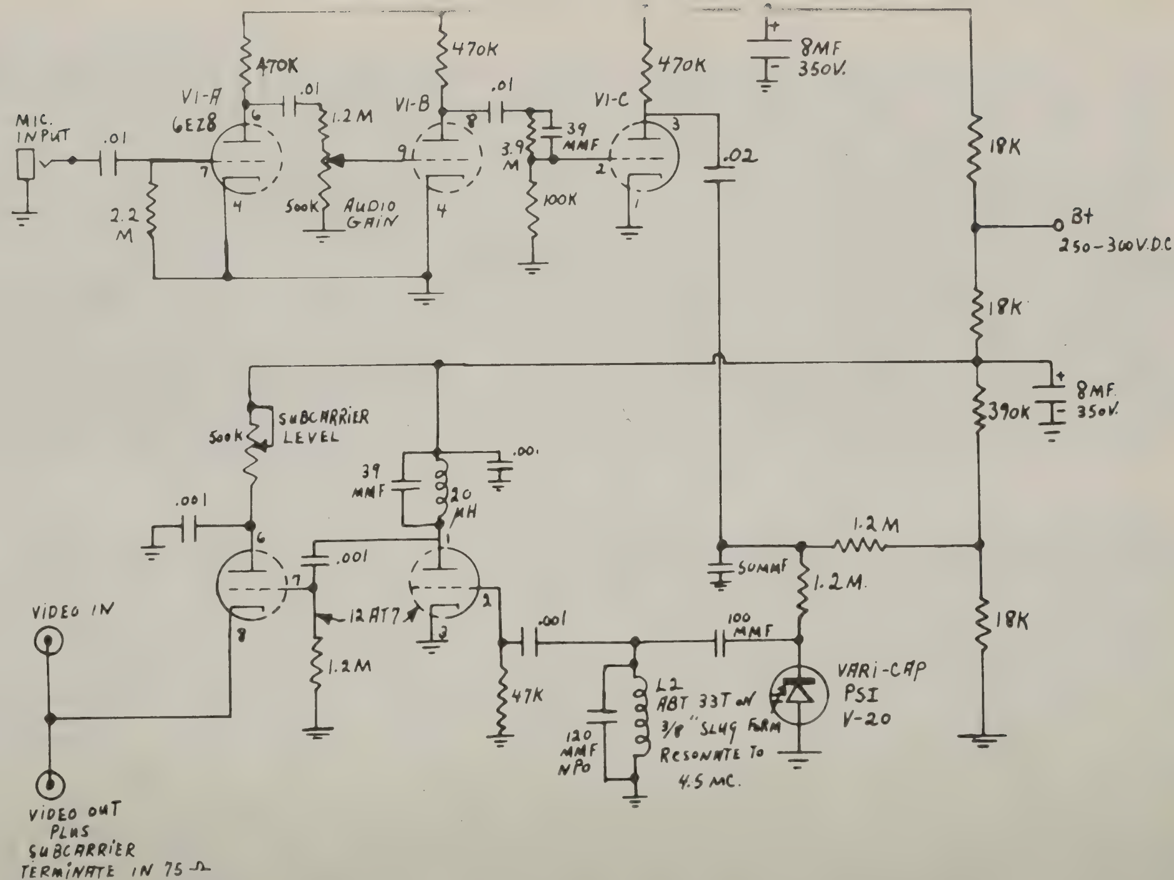
Fig. 4 Modified IF Response

the video and RF bandpass of the transmitter must be sufficiently wide to allow the 25% sub-carrier to actually get out of the transmitter and into the antenna.

Tests have indicated that a properly designed transmitter which is heavily loaded (maximum coupling to the antenna) will have sufficient RF bandpass so this problem probably may be forgotten.

However, most ATV modulators generally do not have a response curve which is flat to 4.5 mc. (My apologies and congratulations to you purists who do). This need not be a problem, though, if you wish to flatten out your modulator don't let me stop you, it won't hurt a thing. The easiest way to compensate for poor video response is to provide a variable output on your sub-carrier generator so that the sub-carrier level may be increased to several times the required amount to provide the 25% level at the transmitter input. If this is done the level is increased until the <u>output</u> level ratio is correct. A scope is helpful in doing this though it can merely be tuned for best signal results. If a scope is not used, one of the sure signs of insufficient sub-carrier is the sudden disappearance of audio when video is added to the transmitter.

A practical sub-carrier gen-



K6MIO Aural Subcarrier schematic diagram using a VARICAP modulator

erator needs to have four things: (1) a 4.5 mc oscillator (2) an audio preamp (3) a frequency modulator, and (4) a video subcarrier adder. Refer to fig. 5 shown below for a block diagram of such a unit.

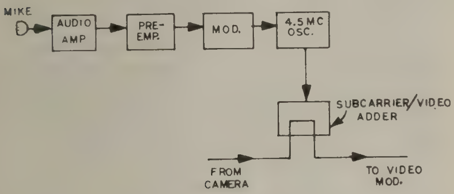


Fig. 5 Block Diagram of Audio Subcarrier Unit.

It has proven its worth and will do a very good job. The varicap modulator is a very stable and simple source of FM. Tests have shown that some increase in frequency stability can be won by using a regulated power supply though it is not essential.

Air checks with this unit showed good results with as little as 8% sub-carrier!!

The able assistance of Joe De Young, WA6CQL in the compiling of the air test information was invaluable and without his help this article would not have been possible.

SLIDE-CAMERA

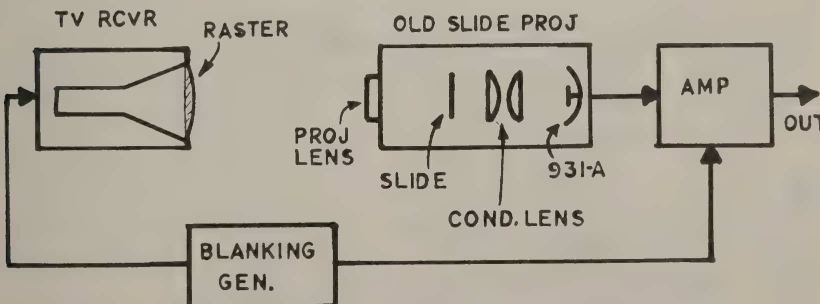
Melvin Dickover, K9EKU
222 South East
Tipton, Indiana

Try this if you want a slide camera quick and easy. Tune a regular TV set to a commercial station and make sure it is properly locked both vertically and horizontally.

Break the lead feeding the video to the picture tube and reconnect it to a blanking generator.

All that remains is to mount a 931-A photomultiplier tube in place of the light bulb in an old 35mm slide projector and focus on the TV raster.

The video signal generated in the 931-A is fed through the conventional FSS correction amplifiers and mixed with the blanking signal in the normal manner to provide a complete slide camera without the need for constructing a scanning light source! See the block diagram below.



WHY NOT INTERLACE?

This is an "idea" type article, but enough research has been done that a construction article could be prepared if interest is great enough.

Ed Baker, WØEDO
9937 Truman Road
Independence, Mo.

Commercial sync generators, which give serrated vertical sync pulses, pedestal blanking pulses, etc. are admittedly complex and expensive. This has given rise to the idea that ALL interlaced sync generators are beyond the reach of the average ham, however, this is not the case! Several years ago RCA came out with a very simple system for interlaced scan which should appeal to all.

The secret of this miraculous sounding gadget lies in the fact that the common blocking oscillator can be used as a pulse counter, and can thus be made to maintain a specific relationship between two oscillators, even on two different frequencies, as long as there is a definite relationship between the two frequencies.

A little arithmetic shows that the standard horizontal sweep frequency (15,750 CPS) is 262½ times the vertical sweep (60CPS) which at first makes it appear that our "frequency divider" method of counting pulses will not work.

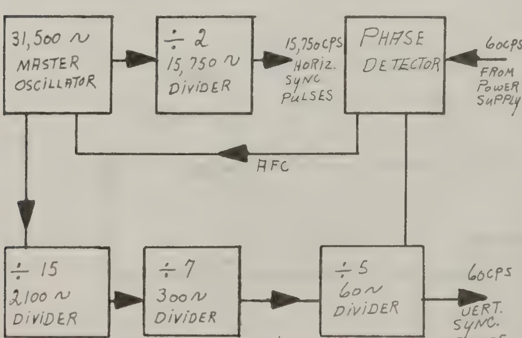
However, if we double the horizontal frequency (31,500CPS) we find that it is divisible by the vertical frequency (60CPS) with a resultant of 525.

Of course to divide directly by 525 would require precision impossible to obtain at the present state of the art, so several divisions become necessary. This can best be understood by referring to the block diagram as we go through the operation of the system.

A blocking oscillator operating at 31,500cps (twice line rate) is used as a master oscillator, and the output fed to two "dividers"...one divides by 2, and gives horizontal sync pulses at 15, 750 cps...the other divides by 15, to give output pulses at 2100 cps to be fed to another divider.

This one divides by 7, giving an output at 300 cps to feed still another divider. This one divides by 5, giving an output at 60 cps...the vertical frequency!

This arrangement alone, when properly adjusted, will maintain the correct relationship between the two oscillators, since any drift in the master oscillator will cause both output frequencies to change by the same percentage, but since the power companies go to great expense to maintain the power line at a fixed frequency, we can apply a small amount of this 60 cps sine wave, along with the output of the 60 cps divider, to a phase detector, and use the resultant as AFC voltage to control the master



oscillator. We now have a sync generator which maintains a precise relationship between the two outputs, and is as accurate as the power line frequency.

The question is no doubt in many minds; Where do we get the components for such odd frequencies as 2100 and 300 cps? The answer is simple. Since the frequency of a blocking oscillator depends almost entirely on the RC time constant in the grid circuit, the main consideration in selecting a transformer is to make certain it doesn't introduce too much loss to the feedback or sync circuits. With this in mind we can use standard horizontal blocking transformers in all the dividers except the one on 60 cps...where a standard vertical transformer is used. A horizontal transformer would also be used in the master oscillator.

Since the horizontal output frequency is exactly 262½ times the vertical output frequency, one frame will begin with a vertical and a horizontal line starting simultaneously, and the next vertical sweep will start 262½ lines later, to give true interlaced scan. This method is, in fact, used in a much more elaborate manner in sync generators for commercial TV stations.

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VIDICON SOCKETS AVAILABLE

Type 7VT 7-contact socket designed for vidicon tubes such as 6198, 6326, 7038, etc. available from Allied Electronics, 100 N. Western Ave. Chicago 80, Ill. Order part # 41 H 349. Mention cat. number—640. Price: $1.40.

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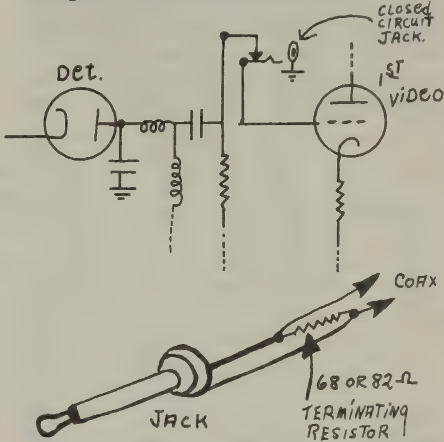
Want to televise very tiny subjects?? Try using economical polaroid closeup lenses.

CONVERT TV SET TO MONITOR

Julien Meyer, WØDYC
Benson, Minn.

If you have no objections to using connectors other than the conventional coaxial type you might try this handy method for converting your TV set into a video monitor. It requires no change over switch, and is very simple and economical.



NOTE: Camera termination goes in the plug. When the plug is inserted the set becomes a monitor...when the plug is removed, the original circuit is restored.

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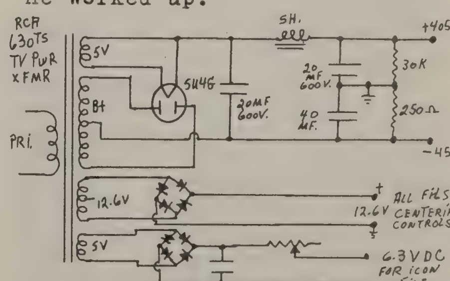
The power transformer from those old RCA 630TS chassis are just perfect for the ATJ/ATK ike cameras. Here is the circuit he worked up.



that dc component

Bruce Robinson
Kingston, Ont,
Canada.

Commercial television in North America uses anegative DC transmission system. This means that if a white area is being scanned at any instant, the transmitted signal is 12.5% of maximum. Similarly, black is fixed at 67.5% with the blanking pulse level 75% and the sync pulse at peak signal. See Figure 1. These four reference levels are called the

FIGURE 1.

reference white and black levels, pedestal level (also known as the blanking or set-up level) and sync level. Benefits of this system include greater efficiency in the R.F. final, simpler AGC and sync circuits in the receiver, as well as far greater tonal fidelity. In amateur practices, we often do not use a DC transmission system with rigidly established levels. However, for advanced, high quality operation, it is strongly recommended that the commercial standards be adopted as far as possible. Let us see how this is done.

You may recall that the output signal from the photomultiplier in a suppressed flying spot scanner resembles Figure 2. Note that since the scanner tube of the FSS is blanked during its retrace intervals, there is no output from the photomultiplier during that time; i.e. we have our black level established. Once

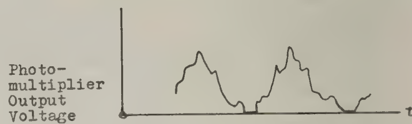


FIGURE 2.

established, however, it is soon lost. After the first coupling condenser in the preamplifier, the signal resembles Figure 3. After amplification, this signal is then normally processed in a Vision-Sync-Blanking mixer, where, as the name implies, the blanking and sync pulses are added. The video signal from the FSS or other picture generator generally meets a DC restoration circuit like in Figure 4.

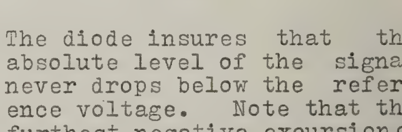


FIGURE 3.

The diode insures that the absolute level of the signal never drops below the reference voltage. Note that the furthest negative excursion of the video signal is the black level. Thus the black level is maintained at the voltage of the diode plate. It is upon this level that the blanking and sync pulses are added. The output of the V.S.B. mixer resembles the waveform of Figure 5, and is called a "composite video signal".

THE BLANKING PULSE: Perhaps at this point, it might be

advisable to digress from the subject and consider the function of the blanking pulse. Figure 1 shows that at the end of each line, the output power must increase to maximum for the sync pulse. If there happens to be a white object at the right hand side of the picture, the signal level would have to change from 12.5% to 100% instantly, if it were not for the blanking pulse. Any delay would upset synchronization and may cause the left hand of the picture to be ragged and unsteady. The blanking pulse, on the other hand provides a stopping off point. The sync pulse then only has to go from the blanking level of 75% to 100% full output each time, independantly of picture content. The blanking pulse has much to recommend its inclusion in any advanced amateur system.

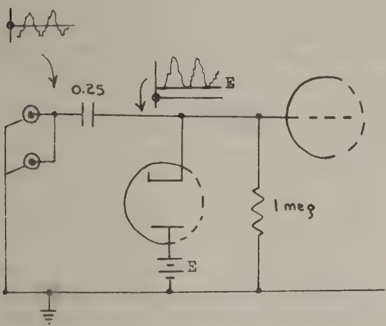


FIGURE 4.
TYPICAL D.C. RESTORER

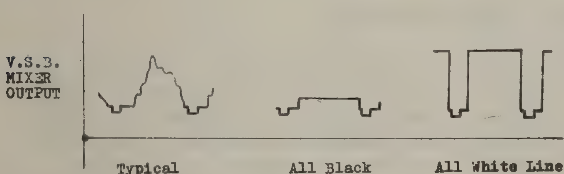


FIGURE 5.

For transmission, the composite video signal is fed to the video modulator, where it is once more restored at the grid of the modulator tube(s).

Proper adjustment of the restorer's reference voltage in this case insures that the sync tip level produces maximum output power from the transmitter. The sync height is then either adjusted in the V.S.B. mixer, or streched in the modulator to establish the pedestal level at 75%. Adjustment of the video amplitude will then place the reference white level at 12.5%.

It is apparent that any picture source to be used with such a system must give the DC restoring circuits something to work with in the form of a return to the black level during each retrace interval. Fortunately, many camera tubes generate a black signal naturally. As an example, a Flying Spot Scanner can generate a black signal if the scanner tube is blanked off during the retrace intervals. Some picture sources cannot readily generate such a signal. A typical example is a FSS scanning negative transparencies. Here, maximum light reaching the photocell should be seen on the receiver screen as black. Similarly, absence of light at the photomultiplier should produce a white portion. To generate an artificial black signal at retrace intervals, it is customary to inject sync pulses into the FSS preamplifier, and to precede the stage into which the pulses are fed with an additional phase inversion stage. The first two waveforms of Figure 6 show a typical signal generated by the photomultiplier at the input to the preamplifier, and after the polarity reversing stage. Sync pulses wide enough to

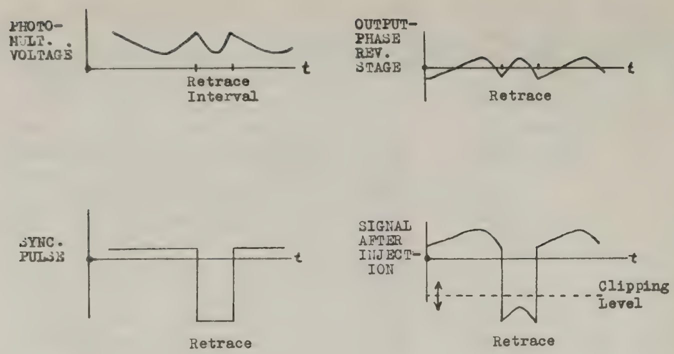


Figure 6

cover the entire retrace periods are injected into the preamp producing a signal as shown in the third waveform of Figure 6. After clipping, the signal has the same general appearance as in Figure 3. An artificial black level has been created for the DC restorers of the V.S.B. mixer to act upon. Other picture sources which do not easily generate a black level are similarly treated.

To sum up then for amateur DC transmission, a natural or artificial black level is generated by each picture source, that may be "reclaimed" by a simple DC restorer. In the V.S.B. mixer, blanking and sync signals are jacked up on the DC level, and the resultant composite video level is sent to the modulator where it is again restored before modulating the transmitter.

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VIDEO CLEARINGHOUSE

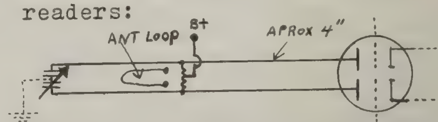
Have you recently had a real stickler that you just can't seem to get the answer to? Or perhaps you can't locate some "hard-to-get" video component.

If so why not send your problem into ATV EXPERIMENTER? Perhaps one of our readers will have the answer to your exact difficulty.

Consider this not as a technical consulting service (since we could not possibly have time to answer all requests) but rather as a clearinghouse which will aid you in locating help.

Outstanding solutions to problems of general interest would gladly be printed in later issues.

To start us off, W4UVU, Jim Grant of 1209 Timber Grove Dr, Knoxville 19, Tennessee sends us this problem to open to our readers:



Jim is using a 6J6 self-excited oscillator for his video transmitter. He would like to know what difference grounding the rotor makes? (See above figure) Presently he is using it ungrounded since it seems to work better. Grounding it would make for easier tuning. No hand capacity, ect.

****

THE CAMERA LENS

A short course in basic lens theory — WØKYQ

If you recently constructed a live camera, such as a vidicon, you are aware of the difficult task of selecting a lens system which will perform satisfactorily and still not cost a fortune.

On the other hand, if you are yet to be faced with this problem you may have wondered where does one draw the line between quality and cost? How well does the lens actually have to be for ATV purposes? What's really needed, a single lens or a turret assembly? What focal length and lens speed will be required? These questions and a host of others, if not throughly understood, could prove to be quite costly both in time and money.

LENS TYPES: Lenses come in six basic forms. These are illustrated in fig. 1. Notice

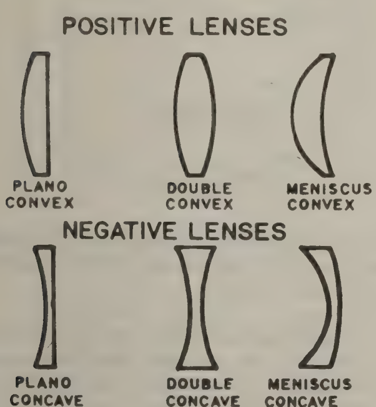
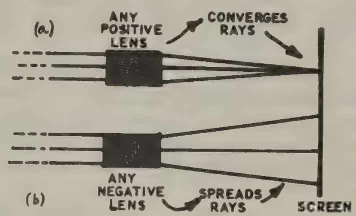


Fig. 1 Six Basic Lens Types

they have been subdivided into two distinct groups...positive and negative.

Positive lenses, which include the plano-convex, double-convex and meniscus-convex (also known as convexo-concave) all have one thing in common; they are thicker in the center than at the edges. This accounts for their ability to focus images onto a screen. (Fig. 2a) In cameras using simple single



*No specific lens type shown.

Fig. 2 (a) Positive lenses focus images. (b) Negative lenses spread rays...do not focus images.

element lens systems, the lens will always consist of one of the three positive types mentioned above.

Negative lenses which consist of the plano-concave, double-concave and meniscus-concave (also known as concavo-convex) are all characterized by the fact that they are thinner in the center than at the edges. This causes rays of light passing through them to spread further apart...thus making it impossible to focus an image on a screen. (Fig. 2b)

Negative lenses are never used by themselves in any equipment where it is necessary to form an image on a screen. They are, however, used in conjunction with positive lenses

for correcting various lens defects. For the moment however, let's concern ourselves with simple single element lenses.

FOCAL LENGTH: A basic characteristic of any lens system is its focal length. For any

Fig. 3 Method for determining focal length of simple lens

single element positive lens this equals the distance between the center of the lens to the point of focus. This distance can be determined as shown in fig. 3.

Position the lens such that the rays from the sun will pass through it. Next place a screen at the point where the image of the sun is in perfect focus (smallest spot of light).

Measure the distance between the lens and the screen. This is the focal length. It is important to understand that the focal length does not change even though the distance between the screen and the lens will vary as you focus on closer objects. The true focal length of the lens can be measured only when using light rays from an infinite distance.

It might be of interest to note that if one could accurately measure the curvature of a plano-convex he would find that its focal length would be equal to the diameter of a circle whose curvature is the same as the lens. In the case of the double-convex, the focal length would be equal to the radius of the circle. (See Fig. 4) The F.L. of the meniscus-convex cannot be illustrated quite so easily as the other two since it has a different curvature on one side than on the other. In all three instances however, the most practical method is to measure the distance between the lens and the focused image.

In the case of multi-element lenses a somewhat different approach is required. Start by following the same method used on the single element lenses. Once this has been completed refocus on a close object until the size of the image equals the size of the object. Measure this distance. Now subtract the first from the latter. This will be the true focal length.

This procedure is necessary when determining F.L. of multi-element lenses since the optical center and the physical center do not necessarily fall at the same point.

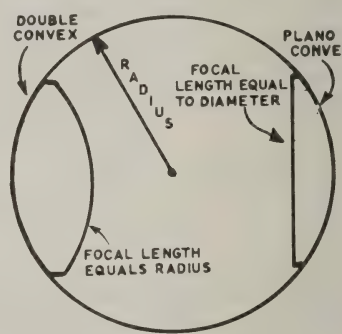


Fig. 4 Focal length relationships for double and plano-convex lenses.

When measuring the distance between the screen and the lens it doesn't matter what point on the lens barrel is used as a measuring reference point since the F.L. is taken as the difference between the two distances.

NORMAL-WIDE ANGLE-TELEPHOTO: Assuming a fixed distance

between the lens and the televised subject, the only difference between a lens of a short focal length and one with a long focal length is the fact that the short F.L. will produce a much smaller image than the long F.L. lens.

To see how this effects the angle of coverage in a TV camera consider the example shown in fig. 5a. Here three different F.L. lenses are shown working in conjunction with similar cameras...all three units are equal distance from the scene. In the case of the short focal length lens a tiny image of the complete scene can be focused down on the small sensitive area of the pickup tube. This lens would be classified as a wide angle unit. In the case of the medium focal length lens however, the size of the image that can be fitted on the sensitive area of the tube is somewhat less...the remainder of the image falls outside of the sensitive target area. Consequently, the angle of coverage of this lens is reduced.

In the third example, a very long focal length has been used. Here the focused image is so large that only a very small portion of the original scene can be fitted onto the target. This results in an extremely narrow angle of coverage and since it effectively magnifies the reproduced picture it would be known as a telephoto lens.

By now it should be quite apparent that the only difference between a normal, wide angle, and telephoto lens is strictly the focal lengths. The pictures as viewed on a monitor from each system are shown in fig. 5b.

In some ATV camera systems, all three F.L. lenses are used. They are either in the form of a turret assembly which is merely rotated to the desired lens; or it is a single lens mount in which case the lens needed at any one moment is screwed into the mount. In either case, the advantage of more than one F.L. lens is to enable the operator to tele-

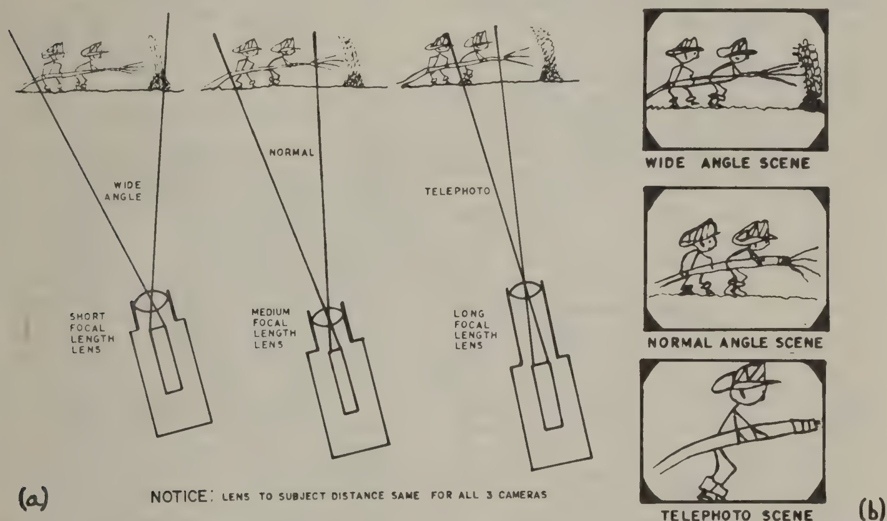


Fig. 5 (a) Angle of coverage varies with focal length of lens. (b) Results as seen on monitor.

vise closeups, normal views and wide angle shots without moving the camera. For the average ATV application this can be considered as nothing more than an extra convenience factor, since in most instances a single lens system will serve equally well...it's just a matter of moving the camera closer or further from the subject, depending whether a closeup or a long shot is desired. It is up to the individual constructor whether he feels that the added convenience of the multi-lense system will justify the added expense of such a system.

LENS DEFECTS: A number of factors limit the effective resolution from any lens system. Probably the two most common are spherical aberration and chromatic aberration. In the case of the first, the difficulty is caused by spherical grinding, a method used not because it produces the most perfect lenses but because it is the most practical for machines to handle. In this case the rays approaching near the axis are focused at a different point than for rays approaching near the edge of the lens. (Fig. 6) Best focus is always a compromise and never perfect. The condition can be improved by "stopping down" the lens or in other words partially closing the variable aperture. This prevents light rays from entering too near the outer edge of the lens. A point is soon reached however, where the light reaching the camera tube is decreased to the extent that the reproduced picture will be too noisy.

In most ATV circuits where the bandwidth will never exceed 200-300 lines this aberration is of minor consequences even when the iris is left wide open.

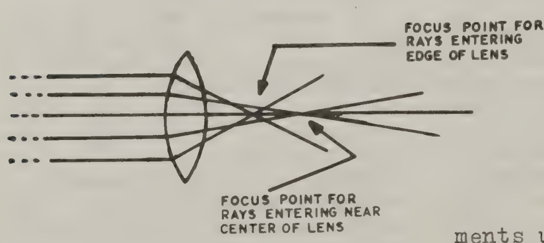


Fig. 6 Spherical Aberration

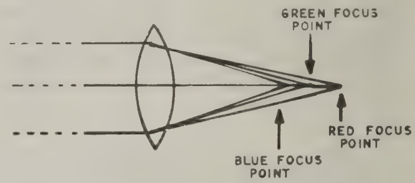


Fig. 7 Chromatic Aberration

Chromatic aberration differs from spherical aberration in that the refractive characteristics of the lens varies with the wavelength of light. Thus red light is focused at a different point than say green light. See fig. 7.

In color photography this condition would show up as color fringing. This condition is corrected in all but the simplest of lenses. It is accomplished by using several different types of lenses stacked together. For example, a positive lens made from crown glass cemented to a negative lens made of flint glass (flint glass has a different refractive characteristic than crown glass) will cancel out aberrations for any two colors in the spectrum. Thus by using a variety of combinations of positive and negative lenses of different types of glass, chromatic aberration can virtually be eliminated. The more elements used, the better the correction and at the same

time the higher the cost. A typical multi-element lens is illustrated in fig. 8. These elaborate lenses are very important in photography where extreme resolution is possible but in ATV where the practical limits are usually 200-300 lines, highly corrected lenses serve little or no value other than to drain the pocketbook.

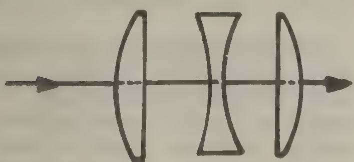


Fig. 8 A multi-element lens.

Other lens aberrations such as astigmatism, distortion and coma provide virtually no trouble for our purposes even when using relatively inexpensive lenses. Remember, what's considered an excellent TV picture is nothing more than a mediocre photograph. Even relatively poor photographic camera lenses are well within ATV aberration tolerances.

LENS SPEED: The speed of a lens is the ratio of its diameter to focal length and is probably the most important quality of an ATV camera lens.

To understand how these two factors are related, consider the following example. Two lenses of the same diameter but different focal lengths are positioned so they are both looking at the same subject. Since both lenses are the same diameter they will be passing the same amount of light yet one lens is considered a slower lens. Why? The answer should be quite apparent if it is recalled that the longer the focal length the larger the image. Therefore, in the case of the long focus lens, even though it passes the same amount of light, it spreads the image over a larger area than in the case of the short focus lens...resulting in a smaller percentage of the light actually striking the sensitive area of the tube.

The speed of a lens system is measured in f/numbers and is determined by the following formula:

$$f/no. = \frac{F.L.}{D}$$

where F.L. is the measured focus distance and D the effective lens diameter. (Fig. 9) As a typical example assume that we had a vidicon lens with a focal length of 1 inch and a diameter of ½ inch. Then according to the formula f/no. equals f/2...a relatively fast lens.

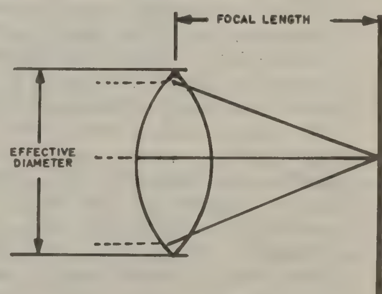


Fig. 9 F.L. divided by diameter equals lens speed.

The f/number markings on lens systems with variable apertures are usually marked such that each successive number indicates ½ the light intensity of the previous...the smallest number representing the largest aperture.

One final thing concerning lens speed. In multi-element units where quite a number of surfaces are present (6 or more) if not coated with a microscopically thin film of material for eliminating

surface reflections (such as magnesium fluoride) the above formula will indicate a lens speed somewhat higher than is actually the case. This however, is not usually the situation since most multi-element systems represent relatively good lenses and are therefore usually coated to minimize such surface losses and make them as efficient as possible.

DEPTH OF FIELD: When a lens is focused for a particular distance, theoretically all objects either closer or further away are out of focus. In actual practice, this is not quite the case. There is a range both in front and behind where the reproduced image will be acceptably sharp. This range is known as the "Depth of Field".

This distance will increase with increased subject to camera distances and with smaller iris settings; it will decrease with closer subject to camera distances and wider iris settings.

By controlling the lighting, video gain, and subject to camera distances one has a great degree of control over the depth of field and subsequently over the control of undesirable background material which one does not desire to televise.

VIDICON LENS REQUIREMENTS:

For operation under adverse lighting conditions a fast lens is necessary; at least f/2.5 or better. When operations are to be confined to places of adequate lighting a medium fast lens of f/4.5 or f/3.5 would be satisfactory.

A variable iris which can be stopped down to at least f/22 is very important. This will allow you to operate both indoors and outdoors and also control the depth of field.

Select a focal length for your own specific purposes. 16mm movie camera lenses work very well for vidicon cameras. Approximate values which will serve nicely for wide angle, normal angle and telephoto are listed below.

15mm-wide angle
25mm-normal angle
75mm-telephoto (3x)

(25mm = approximately 1inch)

Actual focal lengths can deviate slightly from these figures without effecting the angle of view to any great extent. In the case of the telephoto lens if some other magnification other than 3x is desired just multiply the new magnification factor by the F.L. of your normal angle lens. For instance, assume you want a telephoto lens of 5x and the normal angle lens which you are presently using is 30mm. Then the telephoto lens would have a F.L. of 150mm...or approximately 6 inch F.L.

Focusing will be necessary so check to see if it has a focusing adjustment. Some fellows buy fixed focus lenses and then move the complete vidicon and associated coil assembly as a focusing adjustment. This is quite a mechanical problem compared to moving the lens. Even in cases of fixed focus lenses, it's often easier to obtain a couple pieces of telescoping tubing which can be threaded and inserted between the lens and the camera. When using this system be sure to provide sufficient range to focus down to about 2-3 feet.

To summerize then, we could ask ourselves four basic questions about the lens under study.

1. Is the lens speed satisfactory?
2. Does it have an adjustable iris that can be stopped down to at least f/22?

3. Is the focal length correct for my application?
4. Does it have a focusing adjustment or can some provision be improvised?

If these four questions can be satisfactorily answered in light of the above information you have selected a lens system which will adequately serve your purposes.

LENS SELECTION FOR OTHER CAMERAS:

When dealing with lenses for other cameras use the same procedure outlined for the vidicon with the following exceptions.

An f/1.9 or better lens is needed when used with iconoscope cameras, since these tubes are quite inefficient and must have a lot of light. Virtually no light losses can be tolerated. When dealing with image orthicons, the least emphasis is needed on speed, since they are the most sensitive of all image converter tubes.

Determination of focal length for any size pickup tube is very easy. Just measure the diagonal scanning distance of the tube in question. This is equal to ½ the F.L. of a normal angle lens. A wide angle is usually about 35-50% shorter while a telephoto is usually 2-3 times longer.

Iris requirements are the same for the image orthicon as for the vidicon. When it comes to the iconoscope on the other hand, just about anything will do...since most old ike cameras are so insensitive they require all the light possible...even for outdoors operation. Even with the most sensitive it's doubted that you would ever stop the lens down past about f/8 or f/11!

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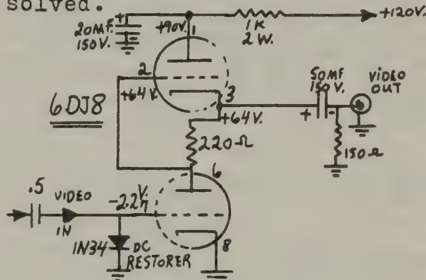
MORE VIDEO FOR THE PARKER CAMERA

Fred Eberhart, W4YUN
Box 242
Madison College
Madison, Tenn.

After building the Parker camera, among other things I found the video output to be wholly inadequate, being far below the standard 1 volt. The problem was how to boost the output while maintaining the proper video phase (positive going) without adding two additional stages. By sacrificing the TV band RF oscillator and thus rewiring the last stage for a 6DJ8 the problem was neatly solved.



Using a cascode (push-push) output circuit puts two stages in the place of one without additional phase inversion while giving the impedance matching advantage of the cathode follower.

A word of advise, while the 12AU7 appears similar to the 6DJ8 do not substitute. The difference in performance is dramatic and well worth the buck extra that the 6DJ8 costs.

I will be glad to correspond and share experiences with anyone plagued with the many difficulties involved in making the Parker camera work.

A POWER SUPPLY MODIFICATION FOR THE BILL PARKER CAMERA*

Jim Kennedy, K6MIO

Many amateurs who have built or will build vidicon cameras will, no doubt, copy designs used by various CCTV manufacturers. It will be found that many of these designs employ half-wave power supplies developing 150 and 300 vdc utilizing rather expensive power transformers. These transformers generally consist of two 150 volt windings in series; with one winding rated at 100 ma and the other rated at 30 ma. Most amateurs will find that a considerable saving can be wrought by substituting inexpensive isolation and filament transformers for the single expensive power transformer. See fig. 1 below.

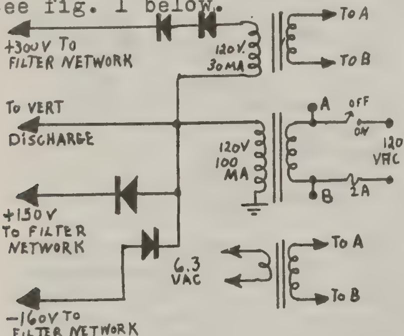


Fig. 1 Original Power Supply

Making such a change is not without its problems. It was found, for instance, that a transformer rated at 35 watts (300ma) in AC isolation service ran very hot at 100 ma DC in a half wave circuit and was severely overheated at 150 ma DC in the same circuit. This effect is no doubt due to the large amount of current drawn by the filter because of the half wave type circuit. It was further found (with the help of K7BGE) that two transformers in parallel each rated at 50 ma DC in a half wave circuit also overheated at 100 ma DC in said circuit.

A satisfactory solution to this problem was found in the following modification. See fig. 2 below.

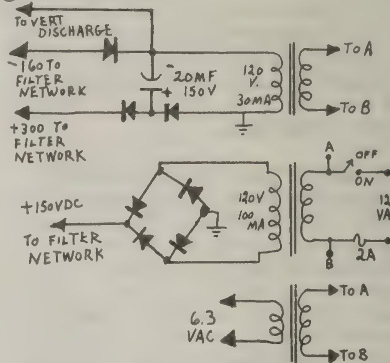


Fig. 2 Modified Power Supply

On the assumption that the problem was due to the half wave filtering current, the 150 VDC 100 ma portion of the supply was converted from a half wave type to a full wave bridge type circuit. This delivered about 145 VDC, still quite adequate. The small 30 ma transformer, initially in series with the 100 ma transformer, was removed from the series circuit and connected as a voltage doubler to obtain 300 VDC and in half wave to obtain -160 VDC. The vertical trigger is also obtained from this transformer. The results obtained were very noticable. The supply ran much cooler and due to the full wave circuit the 150 VDC was much better filtered than before.

The only additional parts required for this modification are three 400 piv 500 ma silicon diodes and a 20 mfd 150 VDC electrolytic capacitor.

*TV CAMERA YOU CAN BUILD, W.E. Parker; Radio-Electronics, May, June and August, 1962.

MORE ON THE TV CAMERA

Larry Perry, K4EFV

The vidicon camera appearing in the May, June, and August issues of Radio-Electronics provides very nice video for use in ATV provided certain other modifications are applied.

After building a replica of the camera appearing in the article and using the LC stablized multivibrator instead of the crystal control for the horizontal oscillator, I found it very hard to get 15,750 cps from the components in the article. A much simpler method appears in figure 1. It may cost about $1.00 more but it is well worth the extra cash layout. It consists of a horizontal blocking oscillator transformer, a capacitor, a resistor, and a pot additional to the original circuit. The width control circuit remains unchanged except that it now runs through the transformer to the plate of the 6DE7 instead of directly. The value of the pot is not critical and I have found that the minimum value is about 180K. The 500K pot used works nicely. With the circuit as shown it is no trouble at all to lock in the raster on the monitor. The voltage chart should come in handy to those who may have trouble.

It is a good ideato mount the horizontal frequency control on the outside of the cabinet as it may have to be adjusted several times initially. The circuit is very stable after the camera has warmed up to operating temperature.

Another modification that may be needed depending upon the power transformer used is that of a series resistor in the HV ac lead. I used the Triad R73B with a 135 volts on the secondary which I thought would give me about 120 volts dc through the silicon rectifiers. After the filter capacitors began to fissile and smoke I decided to measure the voltage across them...175 volts. Then I realized the property of the silicon rectifiers and after replacing the filter capacitors I inserted a 250 ohm 10 watt resistor in series with the 135 volt ac lead from the transformer. With the modification as described I now have a nice 120 volts within the range of the 150 volt filters. I also found that by soldering a 1.0 mfd non-polarized tubular capacitor across the choke I was able to obtain a nice relatively ripple free voltage for the camera. The idea here is to provide a resonant frequency that cancels the ripple component from the rectifiers.

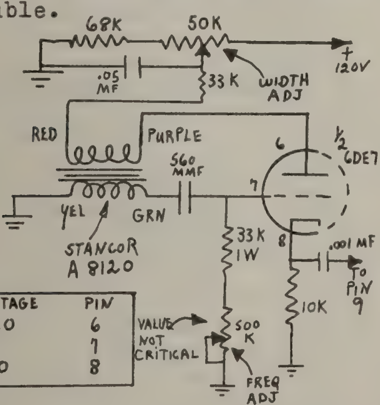


Fig. 1 Horiz Osc Modification

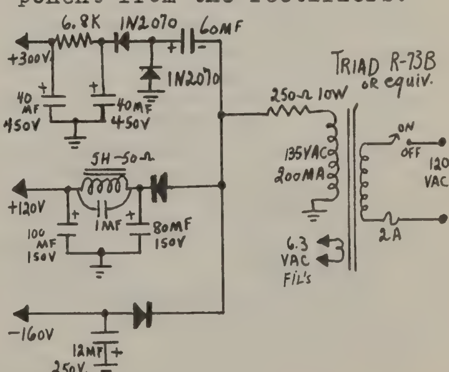


Fig. 2 Power Supply Modification

While on the subject of the power supply, there is one other additional hint that you may consider. Instead of using another 125 volt transformer in series with the Triad already in the circuit to obtain the 300 volts necessary for the HV circuits, try a voltage doubler circuit as shown in figure 2. This circuit works beautifully and you need no additional parts.

With these modifications it is now only necessary to align the camera and connect the video output to your regular modulator. I hope these modifications will clear up most of the trouble experienced in building the camera.

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EXTEND IMAGE ORTHICON LIFE THROUGH A 60 DAY REST PERIOD IN THE DEEP FREEZE!!

That's right! If you have an I.O. camera chain and if your tube is beginning to burn-in or getting noisy, why not retire it from service for about 60-90 days in the deep freeze at 0° F.

Although the scientific explanation for this phenomenon is not yet clearly understood among engineers, it is being experimented with quite extensively by a number of broadcast stations. Results are very encouraging.

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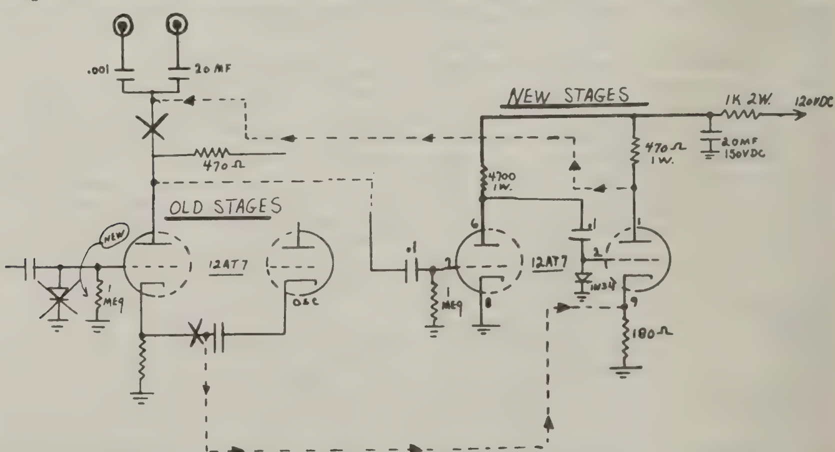
3 VOLT AMPLIFIER MODIFICATION FOR THE PARKER VIDICON CAMERA

Jim Kennedy, K6MIO
2816 E. Norwich
Fresno, Calif.

Add this modification to your Parker camera which appeared in the May, June, and August issues of Radio-Electronics and you will have sufficient output to drive most of the currently popular surplus transmitters as well as give much more contrast to the "Jeep" (RF) signal.

X's show broken connections or removed components. Dotted lines show added connections from old stage to new stage. Video output should be about 3.5 v P-P when fed into 75 ohms.



THE IMAGE ORTHICON

Need a pickup tube that will put out a nice picture with only 0.01 footcandle?

Les Toth
Project Engineer
Diamond Power Specialty Corp.
Box 415 "Personal"
Lancaster, Ohio.

I presume that the readers of ATV EXPERIMENTER also subscribe to 73 Magazine, and read W2RWJ's fine article on vidicons. The following article describes another widely used pickup device, the Image Orthicon.

I would like to point out in the beginning, that at the present time the cost of Image Orthicons makes their use prohibitive for most hams, however some of you with the right connections might be able to locate an inexpensive source of supply of used, or slightly defective Image Orthicons. (HINT: Check with local television stations.)

HIGH SENSITIVITY: Image Orthicons are used almost exclusively by broadcasters, and in industrial applications where a high quality picture is required and the scene illumination is too low for vidicons. One of the main advantages of the Image Orthicon over the vidicon is that it requires considerably less light to operate. As an example, a vidicon such as the 6198 requires at least 2 footcandles faceplate illumination in its most sensitive mode. On the other hand an average Image Orthicon needs only about 0.01 footcandle!

THEORY OF OPERATION: Fig. 1 shows the internal construction of an Image Orthicon. The tube consists of three distinct sections: The image section, scanning section, and the multiplier section. The image section consists of a photocathode, an accelerator grid, and a target, which is a glass disc with a fine mesh screen on the photocathode side. The scene to be televised is focused on the photocathode, which emits electrons in proportion to the amount of light falling on it.

The electron pattern thus generated is accelerated to the target, which they hit with high velocity, causing the target to eject several electrons which are collected by the mesh. This leaves a pattern of positively charged picture elements on the target surface corresponding to the image focused on the photocathode. Focusing in this section is accomplished by an external focus coil, and by varying the photocathode voltage.

In the scanning section an electron gun sends a sharply focused beam of electrons towards the target. This beam is deflected by a magnetic deflection system in synchronism with the scanning beam in the CRT in the monitor. As the beam approaches the target, it is decelerated, so the electrons land on the target with zero velocity. Since the target is very thin, the charge of the picture elements can attract some of the beam electrons, which remain on the target. The remaining electrons in the beam then return to the multiplier section to provide an electron deficiency signal. Due to field distortions they

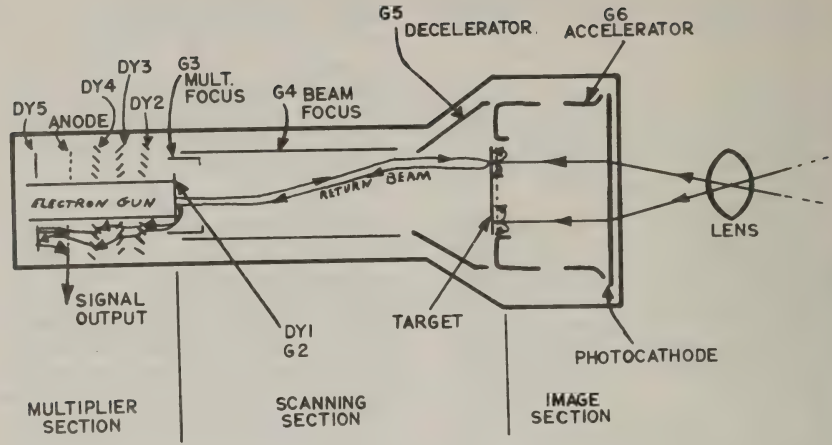


Fig. 1 The internal construction of an Image Orthicon

do not follow the same path going as they did coming, as a result they do not re-enter the gun, but land on the first dynode of the multiplier section.

This section's operation is similar to that of the photomultiplier tubes, utilizing secondary emission for amplification. The five stage multiplier used in most Image Orthicons amplifies the signal about 1000 times. The signal output of the Image Orthicon is considerably higher than that of the vidicon, making high gain in the preamp unnecessary. This usually results in a high signal tonoise ratio, being that most of the noise in camera chains is introduced by the first stage of the high gain preamplifier.

Due to the tube's more complex nature, the associated circuits required are more elaborate than those needed to run a vidicon. Also it requires considerably more care in handling.

To make it as clear as possible lets take each section separately, starting with the multiplier section.

MULTIPLIER SECTION: The operation and external circuit requirements of this section are similar to that of a photomultiplier. For most Image Orthicons an anode voltage of 1200 to 1500 volts is required. The five dynodes (the number usually found in this section of IOs) are operated at a gradient of 200 volts. The anode is maintained at 50 volts above the fifth dynode. Maximum anode current is in the neighborhood of 50 ua. The signal output is in the order of 10 ua.

SCANNING SECTION: In this section the following voltages and controls are required: Grid #1; variable 0 to -120 volts, controls the beam intensity. Grid #2 is connected to and operated

at the same potential as Dynode #1. Grid #3; variable from 200 to 350 volts. This voltage should be adjusted for uniform shading consistent with high signal output. Grid #4; variable from 150 to 250 volts, controls beam focus. Grid #5; variable 0 to 100 volts. This electrode is used to decelerate the beam approaching the target. It should be adjusted for uniform resolution and shading....not a critical adjustment, no fine control necessary.

IMAGE SECTION: In the Image Section the photocathode voltage should be variable from -300 to -500 volts, should be adjusted for best focus (I focus). Grid #6, the accelerator electrode should be operated at approximately 80% of the photocathode voltage.

The target voltage should be adjustable from -3 to +5 volts. In normal operation it is operated 2 volts above the point where the tube cuts off.

During retrace a 10 volt negative blanking pulse must be applied to the target to prevent the beam from striking it. Without this pulse black retrace lines would appear in the picture.

DEFLECTION AND FOCUSING: The deflection and focusing requirements are similar to that of vidicons, however due to differences in construction, IOs require a magnetic field of approximately 75 gausses for proper focus (about 75 ma from most IO focus coils) and also require more current through the deflection coils. The use of an alignment coil is recommended for assuring high resolution.

CARE: Great care has to be taken when handling IOs. Never hold, or operate the tube with the face pointing down; minute particles that might be loose in the neck of the tube may fall on the target or photocathode, blemishing it. Take care to maintain the bulb temperature between 35 and 45 degrees C. At low temperatures loss of signal amplitude, loss of resolution and stickiness will occur. Operation at higher temperatures not only causes loss of resolution, but may damage the tube permanently. Never operate the target at more than 2 volts above cutoff; it causes stickiness and shortens tube life.

Of course all the precautions taken with vidicons should be taken with IOs as well. Never leave the camera focused on a stationary scene for long, IOs are even more "sticky" than vidicons. As in vidicons, if the tube is scanned at less than full raster, this raster will show up in the picture as a darker area when full scanning is restored.

TRANSFER CURVE: One of the peculiar characteristics of the IO is its light transfer characteristic curve. Fig. 1 shows the signal output versus highlight illumination on the photocathode. Most IOs have a very pronounced "knee", the point after which the signal output stays constant, regardless of further increase in the illumination. To the writer's knowledge the only exceptions are the tubes having thin semiconductor (M_gO), rather than glass targets. Their "knee" is more rounded.

It is best to operate the tube so that the highlights bring the output slightly over the knee of the light transfer

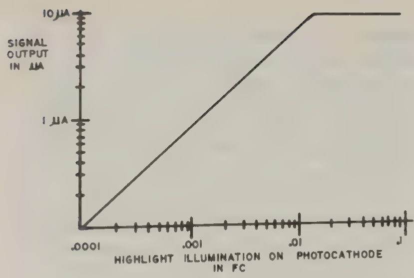


Fig. 1 Light Transfer Curve

curve. On most common IOs the knee occurs around 0.01—0.02 footcandle. Some of the "low light level types" are as much as 100 times as sensitive.

As pointed out earlier, much light on the photocathode shortens the tube life. Always stop down the lens, so that the photocathode illumination never exceeds twice the value of the knee (one lens stop above the knee). Always cap the lens when the camera is not in use. Some studio cameras not only have remote iris controls, but a switch for capping the lens from the console.

Anybody with a good scheme for remote iris control for IO cameras??

W4MS, Eddie Collins sends this hint: A photocell in the light chamber of your 8 or 16mm projector (in place of the projector bulb) focused on a TV raster gives real good movies. Makes for a real handy method of sending TV CQ's!

SURPLUS XMTR BANDPASS are:

ART-26	up to 1.5 mc
ART-28	1.1 mc
APQ-2	3.5 mc
APT-5	3.0 mc
AXT-2	4.5 mc

NOTE: AXT-2 only one with sufficient bandpass to allow 4.5 mc subcarrier operation.

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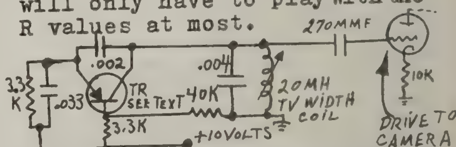
ULTRASTABLE OSC FOR CAMERAS

R. Suding, W8NSO
814 Nichols Dr.
Pontiac, Mich.

I don't like the instability of the LC or RC type circuits for most vidicon cameras and didn't want the expense of an xtal circuit. As a result, I set out to modify the ARRL Handbook transistor grid dipper circuit for a good free-running horizontal oscillator circuit. The circuit requires about 10 volts positive. The focus coil of the Parker camera just happens to have this amount across it, so that is the DC source. The coil is a TV width coil, and should be shielded for maximum stability.

A number of these have been made up, and the transistor doesn't seem to be critical at all. I have used a 2N43 and a 2N109. Try any old PNP, as you will only have to play with the R values at most.



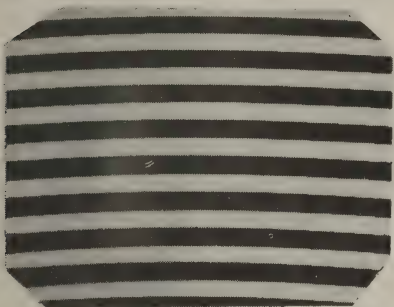
Stability wise, it's fabulous. It stays on the exact frequency regardless of the other control settings and even a change in supply voltage has almost no effect. A frequency test showed 1 cps change with any change of control settings!

CHECK MONITOR LINEARITY

Get tired of trying to locate a broadcast station when they are transmitting a test pattern inorder that you might check the linearity of your set? If so, look no further. Try this simple system.

Connect any audio generator which has a range of about 5kc to 150kc to the video input stage in the set.

Now adjust the level and frequency till the set locks on the desired number of bars. For example: a frequency nine times the vertical scanning rate (9 x 60=540cps) will yield 9 horizontal black bars; perfect for adjusting the vertical height and linearity controls.



Vertical linearity test

On the other hand, a frequency 9 times the horizontal scanning rate (9 x 15,750cps=141,750cps) will yield 9 vertical black bars; perfect for adjusting the horizontal width and linearity controls.

Horizontal linearity test

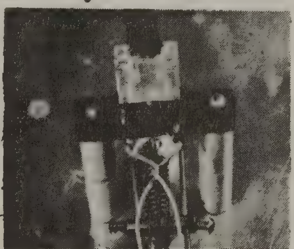
When you have all the controls properly adjusted the bars in both the vertical and horizontal position will appear equally spaced similar to those in the photos.

******

UNIQUE UHF ANT CONNECTOR

W4LSA

Soldering antenna transmission lines directly to the link on UHF transmitters is not a bit uncommon. This is mainly done for lack of cheap and readily available UHF antenna connectors. Well look no further! Try using a standard xtal socket and matching plug. The plug works beautifully on 300 ohm UHF transmission line and the socket mounts up on the transmitter to provide a very neat looking connector. (See photo.) For extra low loss it is suggested that you mount the socket on a standoff insulator rather than mounting it directly on the chassis.



Only one word of caution: if you mount it so its terminals are expected to provide support for the link, it would be a good idea to put a drop of cement on each of the pins. This will keep them from wiggling in their mount and thereby prevent the link from moving and possibly throwing the rig out of tune everytime the antenna is plugged in or out of the socket.

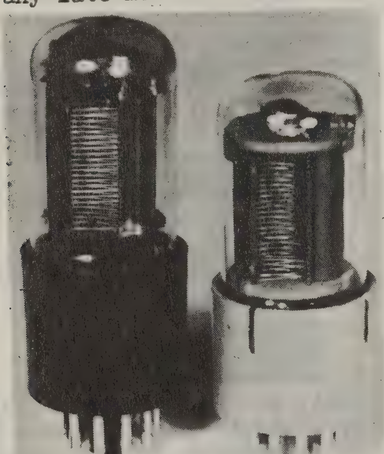
An extra plug with a light bulb of the appropriate size permanently connected to it will provide a handy and always available dummy load.

HAM TV IN THE JUNK YARD!!

Always looking for new sources of supply, I found that 931-A (or at least their equivalent) photomultiplier tubes can be can be found in automatic headlight dimmers on many cars. Best source of supply..a junk yard! These units are located on the top, right hand side of the dashboard.

These were optional equipment on Buicks, Old's and Cad's as early as 1953. Some Chrysler cars were also equipped with these units but they are more difficult to locate.

I don't think you will find any late model cars in the junk



yard, however we found 1955-1960 Old's and 1955-1960 Cad's were the best possibilities.

Each unit contains a one meg pot, 4 meg resistors and a photomultiplier tube. The tube is slightly shorter than the conventional 931-A but retains all the electrical characteristics of this popular tube. See the above photo.

You may find some units with a CRL ceramic type printed circuit socket. The socket can be used simply by scrapping the printed circuit off with a razor blade and scrubbing with soap and water.

Suggestion: Talk to the junk dealer first and offer him 50¢ to $1.00 per unit. This is a reasonable price and the unit is of no real value to him anyway since there is very little call for the units. Happy hunting!

Joe Forth, WA2TRT
123 St. Boniface Rd.
Cheektowaga, 25, N.Y.

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ATK CAMERA OWNERS:
Turn out those lights!

Do you have a 35mm slide projector and one of those old surplus ATK/ATJ cameras? Why not combine the two and transmit your favorite slides via ATV?

Simply remove the lense from the camera and project the slides directly onto the sensitive mosaic area of the iconoscope. It may be necessary to add an iris to the front of your projector to reduce the light output to the required level.

This is easy. Just punch a small hole in a piece of cardboard and tape it directly to the lense barrel of the projector. The size of the hole must be determined experimentally depending on the wattage and F No. of the lens on your individual projector.

NARROW BAND TV??.....SI!!!!

Narrow band TV offers great possibilities not only if allowed on 6 and 2 meters but even on 420 mc. Read W3AEH's approach to the problem.

Al Lipkin, W3AEH
6615 North Uber Street,
Philadelphia 38, Penn.

Amateur television (ATV), although dating back to the Nipkow disc, has shared avery limited followingin the amateur fraternity. This lack of interest, for the most part, seems to be due to:

(1) The lack of technical information available to the average amateur.

(2) A scarcity of inexpensive equipment and/or parts.

(3) The extremely limited range of operation at the frequencies presently allocated for the transmission of A5 modulation.

With the advent of closed circuit industrial television, the first two factors are eliminated. Electronic periodicals (Electronics World, Radio-Electronics, etc) have provided detailed descriptions of the latest ITV equipment. Additionally, there are excellent technical books available, for example; WØKYQ's HAM TV, and CLOSED CIRCUIT AND INDUSTRIAL TELEVISION by E.M. Noll. (The latter available from Denson Electronics). An ever increasing number of military and commercial TV gear is reaching the surplus market and is being offered at relatively low cost.

There is but one stumbling block remaining then, retarding the growth of ATV, and that is the limited range imposed by the UHF frequencies presently employed. Inasmuch as the present TV standards require a bandpass of at least 4 mc and often as high as 12 megacycles it is obvious that the lowest ham frequency capable of handling such information is the 420-450 mc band. This within itself is bad enough but to further complicate matters TV operation is restricted (by mutual agreement) to the upper portion of the band! The answer to long distance ATV seems to lie in a restricted bandpass system with its adaptability to the lower ham bands.

In this article I will describe a proposed set of standards for such a system. Any comments directed to the author or WØKYQ regarding this system would be well received.

Before continuing it might not be a bad idea to refresh yourselves with the ONE-MC proposal presently before the FCC. See last issue of ATV EXPERIMENTER.

PROPOSED SYSTEM: The restricted bandpass TV system (RBTV) was designed to satisfy the following requirements;

The system should have:

(1) The ability to accomodate a wide latitude in design at the transmitting location while retaining full compatibility at the receiving end. For example the ATV novice can get on the air using only the simplest of equipment, or the advanced technician may transmit a relatively high quality picture, having over 200 scann-

ing lines with a horizontal resolution exceeding 200 elements per line.

(2) The ability to use standard TV receivers with only slight modifications.

(3) Provision for transmission of audio with the video signal via a common transmitter.

(4) The ability to use an RF bandpass of 1 mc or less.

(5) The ability to allow the standard broadcast TV signal to assist in the set up or checkout of equipment.

The final specifications were arrived at after many scanning combinations were tried and later discarded, for one reason or another. In some cases the system was practical but the equipment necessary was overly complex. In addition to setting a requirement for the sync generator (in interlaced operation) to have no more than two frequency dividers, the problem was complicated due to conflicting factors. For example, in an interlaced system the number of scanning lines per field is required to end in a fraction, while the frequency dividers must have division rates equal to a whole number. The math involved indicated there were few scan rates that would satisfy all the system requirements.

Once the receiving equipment is modified for the system standards, i.e. changes necessary to utilize the different horizontal scan rate and sound subcarrier, no further work is required at the receiving end. At the transmitting site there are three different scanning techniques to pick from, and a choice of three RF bandwidths that can be used.

(1) The simplest picture possible in the W3AEH-TV system uses a horizontal scan frequency of 3150 cps and provides a 50 line raster, non-interlaced. Although the 50 line picture does leave a lot to be desired, resolutionwise, it does allow for simplified equipment and set up procedures to be used. The sync generator may be dispensed with, as no interlace is required. A fast check of the horizontal scan frequency may be made by tuning in the modified broadcast receiver to a local commercial station, and adjusting the horizontal hold for five pictures, side by side, on the CRT screen. (3150=1/5 of 15,750cps) The receiver AFC should be disabled for this test, due to the possibility that the 5:1 frequency difference will generate a correction voltage from the phase detector and cause the horizontal sweep oscillator to be pulled off frequency.

The apparent vertical resolution may be increased by the use of an aspect ratio of 2:4, this change requiring only slight readjustment of the vertical height control in the camera and all viewing monitors. Prolonged use of this aspect ratio should be avoided where the camera tube target area might be damaged by underscanning.

(2) The following method of scanning is a more realistic form of operation which could serve the majority of ATV enthusiasts with a picture quality comparable to the medium fidelity of the amateur voice signal. Using a 105 line picture, it retains a horizontal scan frequency of 3150 cps and employs a 2:1 interlacing arrangement identical to that of standard broadcast operations. Two fields are required to sweep the screen to form the complete picture, the first scanning the odd numbered lines, the second, interweaving between the lines of the first field

to form the evennumbered lines of the picture. A sync generator, such as that shown in figure 2a may be used to provide synchronization for this system.

(3) The third method, as shown in figure 1, is well suited for the advanced experimenter or where high resolution is desired. Vertical resolution on the order of 100 or more, and a horizontal resolution above 200, is attainable using a 4:1 interlace sync

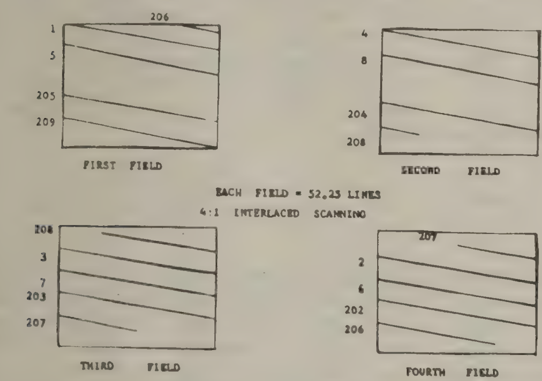

FIGURE 1

generator (figure 2b) in conjunction with the 800 kc video bandpass to be described later. Note that a horizontal frequency of 3135 cps instead of 3150 cps is necessary here. There being only a 15 cycle difference, the receiver AFC will remain effective for either frequency.

Of course nothing is gained without compromise; in this case, it is the frame rate which, requiring four separate fields to form one complete picture, dictates a frame rate of 15 per second. This factor could tend to limit the maximum rate of motion in subject material, however the use of interlaced scanning rather than switching of an entire frame, as in motion picture photography, cause no more objectionable flicker, and possibly less, than that of the 16 frame per second rate of home movie equipment. The persistency of the vidicon camera tube should preclude this objection.

Figure 3 shows the sync pulse width, line and field time duration at these scanning rates. Also shown is the relative levels of the composite sync, video and audio signal with regard to transmitter power output. It should be noted the dynamic range of the video signal is slightly compressed as compared to commercial standards. This is to aid in the synchronization at the receiving location during heavy QRM conditions. It also allows the audio subcarrier to be transmitted with a minimum of interference to the picture, even under peak white conditions.

Aside from the scanning options, the second area wherein a wide latitude in design exists is the transmitted RF bandpass. Figure 4 illustrates the choices available; 4a being the simplest, using double sideband techniques. The drawback here is that only ½ the bandpass is actually necessary for reception. Two stations, using the spectrum profile of 4b, could use a 1 mc channel simultaneously or even work duplex.

The bandpass diagrammed in 4c is useful in high resolution work and is perfect for the 4:1 interlace system mentioned previously. The video information transmitted can be expanded further using suppressed carrier SSB techniques, but this would probably entail further modifications in the receiver.

The remaining problem in the

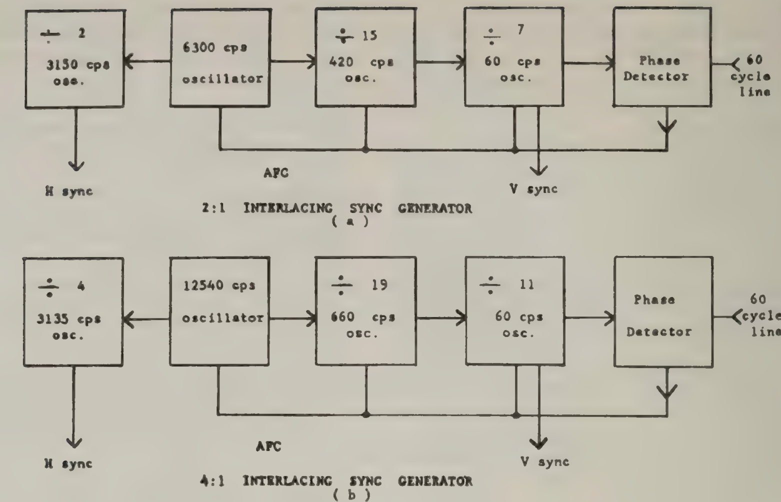

FIGURE 2

RBTV system is the transmission of audio. The simplest solution would be to use existing voice transmitters (when available) on whatever frequency is convenient. This method has its drawbacks, especially in the case of portable operation, where redundant equipment as well as additional power and space requirements are necessary. Compatibility is also lost by this technique, for example; each station in the QSO may operate on a different amateur band and not have receiving capability for the other stations frequencies.

A second method is to follow commercial practice and utilize a separate voice transmitter whose carrier is spaced the required amount away from the video carrier. This again will leave us with the problems of redundant equipment, space,

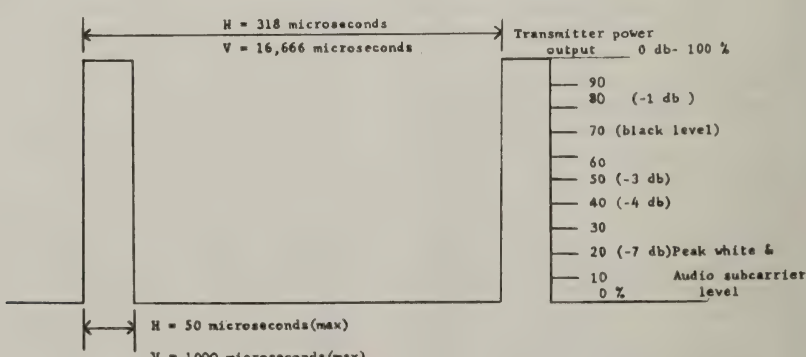

FIGURE 3

power, etc., and also frequency drift of either carrier.

The obvious solution is to use an audio subcarrier mixed with the video signal on a common transmitter. An FM modulated subcarrier of either 450 KC (deviated ± 5 KC) is used to modulate the video transmitter. The tenth and ninth harmonic of these subcarrier frequencies (respectively) is 4.5 mc. This greatly simplifies audio reception, requiring only that a harmonic generator (possibly a diode or an amplifier-limiter arrangment) be inserted between the receiver video output and the 4.5 mc sound i.f. strip. In the case of split receivers, a 900 kc slope detector can be added to the chassis, its output fed to the audio amplifier, or the received subcarrier may be connected to an AM broadcast receiver having a 455 i.f.; either tuning slightly off 900 kc or coupling into the i.f. strip will accomplish slope detection of the FM signal.

I think a system such as this can be useful to a majority of the ATV types. It allows a station to get on the air with as simple or as complex a system as is desired without imposing any severe requirement on the receiving equipment. It is felt a narrow band system such as this can successfully make use of the "dead zone" frequencies now lying dormant by the majority of the VHF population.

A few points of interest regarding the RBTV system; high quality audio, or especially telemetry tape recorders, when used as a video recording medium will yield surprising results; also, use of these scanning rates, coupled with the full 4 mc video response will permit a picture having a horizontal resolution exceeding 2000 (theoretically, actually limited by spot size) to be transmitted. Of course this requires operation on the higher UHF bands, and has very limited application.

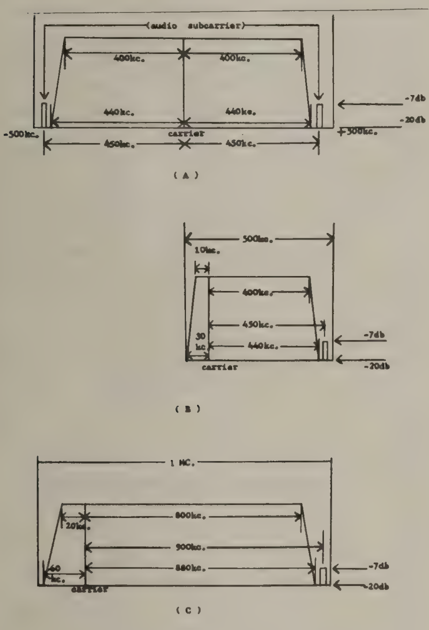

FIGURE 4 (a) proposed standard for the simplest ONE TV system. (b) proposed standard using suppressed lower sideband techniques. This would allow two stations in a one mc channel or allow for duplex type operation. (c) proposed standard for high resolution work using 4:1 interlace.

****

Bill Jack, WA4LGO has put his two cameras to use in a novel way. He has the two mounted side by side (lenses about 4 inches apart) and synced to a common generator. The output from one camera is fed to the red amplifier in his color set while the output from the other is fed to the blue amplifier. With the green gun biased off he has a live 3-D TV system providing, of course, he views the monitor through red-blue filter glasses like those we used to use to look at 3-D comic books.

SELECTION OF TUBES FOR VIDEO AMPLIFIERS

BRUCE ROBINSON, VE9OX
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297 Yonge St.
Kingston,
Ont, Canada

In an R-C amplifier, the mid-frequency gain of a pentode is approximately $g_m R_L$ and the frequency at which the high frequency response

$$\frac{1}{2\pi R_L C_t}$$

where
g_m=tube's transconductance
R_L=load resistance
C_t=capacity shunting R_L

The gain-bandwidth product of a given circuit is then

$$\frac{g_m R_L}{2\pi R_L C_t}$$

and is fairly constant. Thus for any given gain requirement, the circuit will have a certain maximum bandwidth, and vice-versa.

The "figure of merit" of a pentode is often defined as:

$$M = \frac{g_m}{C_t} = \frac{g_m}{C_L + C_o + AC_{gp} + C_d}$$

where
C_L=tube input capacity
C_o=tube output capacity
AC_{gp}=Miller effect capacity
C_d=stray capacity

The figure of merit of a number of common pentodes is listed in table 1 on the following page. Values are given for stray capacity of 10, 20 and 30 mmfd. The tube gain "A" is assumed to be 15 for computation of the Miller effect capacity. Column 7 indicates whether the suppressor grid is isolated from the cathode. It is often used in video amplifiers for blanking insertion.

The best tube in this list is the D3a, a "high slope tetrode" manufactured by the General Electric Co. of England. It has a plate dissipation of 4 watts and is described by G.E. as "having a slope of 35 ma/v and being suitable for use in wideband amplifiers". Price is probably rather high. The 6EW6 is a good bet, as is the 6DK6.

This figure of merit is based solely on small signal gain-bandwidth considerations. For large signal applications, like CRT drivers, etc, the maximum obtainable plate current swing is more important than the tube's transconductance or capacity. For the vast majority of video applications, however, this figure of merit is a good guide.

TRIODES: A rule of thumb in the art of television is "anything you can do with pentodes, you can do with triodes, if you think long enough." As video amplifiers, the better low μ triodes include the 6BL7, 12BH7A, 12AU7 and 6SN7. Among medium μ triodes, the 6U8, 6X8, 6J6 and 12AT7 are good. In computing the gain of a wide-band pentode R-C amplifier, the effect of plate resistance is ignored as it is at least 20 times the load resistance. With triodes, however, r_p is often the same order of magnitude as the load resistor.

This complicates the expression for gain-bandwidth product, and obviates any simple expression for figure of merit. The gain of a triode R-C coupled

TUBE TYPE	g_m	r_p	FIGURE OF MERIT FOR C_d 10 MMF	20 MMF	30 MMF	ISOLATED g_3	REMARKS
D3a	55,000	0k	1,5[illegible]0	1,094	333	yes	English G.E. Co.
6AC7	9,000	1 meg	343	243	195	yes	
6AG5	5,000	300k	232	177	129	no	
6AG7	11,000	130k	350	266	214	yes	
[illegible]	9,000	500k	400	277	212	yes	obsolete
6AK5	51,00	500k	259	159	138	no	old faithful
6A[illegible]	7,[illegible]00	170k	390	260	195	no	
6AQ5	4,100	52k	154	112	98	no	
6AU6	5,200	1 meg	254	170	123	yes	
[illegible]	[illegible],100	500k	331	215	159	no	
6BQ7A	6,400	-	457	266	188	-	low output capacity, cascode circuit pentode section
6CB6	8,000	280k	423	287	205	yes	
6CL6	11,000	90k	35[illegible]	287	227	yes	
6DK6	9,[illegible]00	350k	527	343	254	yes	Low C
6E[illegible]	14,000	200k	609	424	326	yes	small signals only
6U8A	5,000	200k	2[illegible]2	180	133	no	pentode section
[illegible]X8	5,500	300k	325	204	149	yes	pentode section
12BY7A	11,000	93k	447	318	224	yes	
EF[illegible]60	25,000	-	968	708	552	-	English tube
E180F	16,500	90k	805	541	407	-	Like 6688
WE404A	12,500	-	637	422	317	-	
WE436A	30,000	-	950	721	581	-	
7587	10,600	200k	570	369	274	no	Nuvistor

TABLE 1

amplifier is equal to:

$$A=\frac{\mu R_L}{R_L+r_p+(1+\mu)R_K}$$

where
μ=tube amplification factor
R_L=load resistance
r_p=plate resistance
R_K=cathode resistance

If the cathode is bypassed, R_K in this expression reduces to zero. One way of computing the amplifier's bandwidth is to compute the bandwidth of the circuit with the tube removed and replaced with its output capacity. The upper frequency limit, f_2 is determined by the magnitude of R_L and the tube capacities and the stray capacities. Then the bandwidth with the tube inserted is

$$f_2'=f_2\ 1+\frac{R_L}{r_p}+\frac{\mu R_K}{r_p}$$

The second term R_L/r_p is caused by the finite plate

resistance of the triode. The third term

$$\frac{\mu R_K}{r_p}$$

is introduced by the cathode degeneration. Again, if the cathode resistor is bypassed, R_K reduces to zero. Bandwidth expansions of the order of 3.5 are common with triodes.

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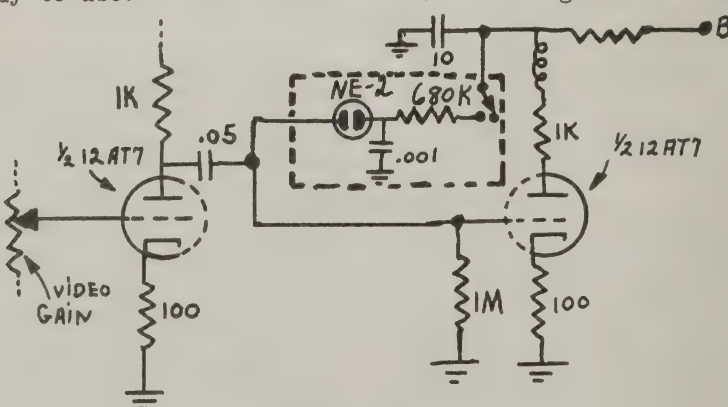
BAR GENERATOR

Jim Ahlstrom, K3MXU
Glenside, Penna.

If you are having difficulty making initial contacts this 82¢ item can completely change your chances for success...believe or not!!

To establish initial video contact, many hams feed a 300 or 360 cps signal from an audio oscillator into their video modulator. Although this is rather inconvenient, the resultant horizontal black and white bars are easy to spot in the snow...even if the antenna is not perfectly aimed. On first thought it may be hard to believe that a group of black and white bars would make the difference between picking up a good TV picture and none at all....but it most certainly will!! If this is the case then why not build a handy 82¢ oscillator right in your modulator where it will always be ready to use?

Schematic of such a generator is shown below. Only one panel control is required and when turned off has no effect on the modulator. If all parts are purchased new (how ridiculous), the whole thing should cost about 82 cents! Keep the lead from the NE-2 to the grid short, and for the modulator shown in WØKYQ's HAM TV book, connect it to pin 7 of the 12AT7. For other rigs, put it where it works best. The values shown are about right, but variations in the neon bulb and supply voltage may make changes necessary...this is best checked by watching on nearby monitor to see if the bars are locked if not change the 680K slightly.

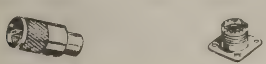


Television Standards

Bruce Robinson VE9OX
297 Yonge St.
Kingston, Ont.,
Canada.

The establishment of standards for TV equipment is important right now when amateur television is really getting off the ground. Why? Well, consider an incident at a London, England ham convention a decade ago: Two amateurs arrived to put on a demonstration of ham TV. One brought his camera, the other a transmitter. It was only at the convention that they realized the transmitter required a 10 volt, white positive signal, while the camera was designed to deliver 1 volt with white negative! They probably had incompatible connectors, too. To prevent occurrences like this from happening all the time, amateurs have more or less accepted a standard signal: all equipment that is to generate or receive sync pulses or video signals should use 75 ohm cable with a 1 volt peak to peak signal level, white going positive, sync negative. Connectors are generally of the UHF series (e.g. Amphenol SO-239 and PL-259...see fig. 1.)

This standard is of extreme importance to those with complicated rigs involving many



CABLE CONNECTOR   CHASSIS CONNECTOR

Fig. 1 Standard cable connectors

program sources, monitors, etc., as it makes possible the pooling of equipment for public demonstrations and it facilitates the sharing of schematics and data. It is also important to the beginner as it makes provision for future expansion. If his transmitter is built to the standard, then any future camera, flying spot scanner etc. will plug right in.

There is a tendency for amateur television equipment to use one or two common power supplies, rather than separate supplies on each chassis. To simplify the exchange of equipment, schematics and data, it is to our advantage to standardize as much as possible on power voltages. For general use, +250 volts, -108 and -150 volts DC and 6.3 volts AC seem a good compromise. Of course for self-contained units like many camera units with integrated power supplies, this doesn't apply.

There are a number of non-electrical standards too: like 3.75 I.P.S. tape speed for tape letters and lectures. To exchange slides for flying spot scanners, 35mm slides are recommended (24 x 18mm), If in color, they should be positives. If black and white, negatives are recommended as they are easier to make.

DON'T FORGET THE BEGINNER: A lot of the new ATV equipment on this continent uses separate time bases in each scanner or camera. Usually the vertical sweep is synchronized to the power line while the horizontal sweep is free running and non-interlaced. Thus, switching program sources creates momentary vertical and horizontal instability in monitors and receivers. For more advanced

rigs, one central synchronization generator is used, often one which generates the complete commercial waveforms: vertical drive, horizontal drive, mixed sync and mixed blanking. All program sources are synchronized to this generator and thus to each other. Stable switching, mixing, dissolves and special effects then become practical.

This complicates matters a great deal, as various pulses must be fed to each camera, scanner, monoscope, etc. So, much is to be said for the simplicity of having separate sweep units in each program source. No standardization of this aspect of ham TV is practical or even desirable as any compromise would be too complicated for the inexperienced newcomer to ATV.

You are in no way obligated to accept these standards, but I think everyone will agree that their general acceptance would benefit the hobby.

(Editor's note) This is an important subject. Your comments on these and other standards are hardily welcomed. Later we would like to print a complete listing of all standards most practical for our ATV applications. Keep in mind however, that this is in no way attempting to devalue the importance of free running, single unit type equipment. On the contrary, the role this type equipment has played towards getting the ball rolling for many an amateur is immeasurable! Many an inexperienced amateur would have thrown up his arms in discouragement without the access to such equipment. Even here though, certain basic standards should be observed...such as 75 ohm outputs, sync negative, etc. So let's hear your comments either pro or con.

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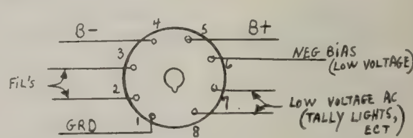
STANDARDIZATION

Here's another article on that important subject of standardizing ATV gear.

Larry Perry, K4EFV
Box 25
Madison, Tennessee

Wouldn't it be nice if all amateur TV enthusiasts had a standard by which to build equipment and operate their stations? This article contains but a short summary of the possibilities of standardizing plugs, cable markers, etc. There are no doubt many others that could be included, but these are the ones that I consider most important.

PLUGS: If the camera is operated by an external power supply such as would be the case of the ATJ/ATK series the octal 8 pin type plug would be ideal as wired below.



For those who don't prefer the octal type plug for some reason any of the Cinch Jones Series 300 plugs and sockets can be

used if they are wired with the pins connected as shown below and a short matching piece of cable with an octal plug on one end and a matching Cinch Jones plug or socket on the other end is kept handy for visiting TV enthusiasts with the octal plug. At the power supply the socket should be of the female type to keep the H.V. from being exposed. The socket at the camera should be of the male type again so that no H.V. will be exposed when the power supply cable is loose. The cable will have female type plugs on both ends so that it doesn't make any difference which end is plugged into the camera and into the supply.

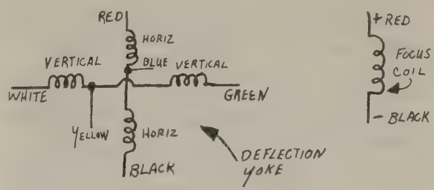
Pins	Connections
1	Gnd
2	Fil (6.3VAC)
3	Fil (6.3VAC)
4	B-
5	B+
6	Neg low voltage*
7	low voltage AC*
8	low voltage AC* (tally lights etc)

* when needed

It has been my experience to not put video or sync on the same plug or connection as the power supply as 60 cycles seems to creep in on the video regardless. Thus for the video output from the camera I suggest the regular coax connector (SO-239 or 81R). The same goes for the sync connector.

The input to the modulator from the camera should also be of the regular coax connector type.

COLOR CODING: For those who wind their own coils may I suggest a coding system be used as below. This coding system seems to be pretty well standardized throughout the TV industry.



For the actual internal wiring of the equipment, the color coding as explained in the Radio Amateur's Handbook will prevail.

OTHERS: For the antennas, I suggest horizontal polarization since that is the present commercial standard, virtually all home antennas are mounted that way. Of course this will vary from area to area as far as ATV enthusiasts are concerned.

For an operating frequency I suggest 442 mc since this is high enough to prevent interference from the gang experimenting with very selective equipment and yet can be obtained by tripling from 2 meters as seems to be the case in most stations. Another advantage of this frequency is that most UHF TV tuners will reach this frequency without any adjustment or padding of the oscillator.

The standards mentioned here are only possibilities and could be changed, but I think this is a step forward in the standardization of the equipment used in ATV experimentation. By standardizing connectors, cables, etc., all members of the Ham TV fraternity could exchange equipment and pool equipment without the necessity of figuring out modifications of existing connectors, etc.

MODIFICATION OF COMMERCIAL UHF CONVERTERS ON THE ATV BAND

Here's how WA2TRT solved the problem of ATV reception!

Joe Forth, WA2TRT
123 St. Boniface Rd
Cheektowaga, 25, N.Y.

Having completed our cameras and transmitters, the problem arose, what to do about the receiving end? As the title implies, a UHF converter feeding a conventional TV set was considered to be the easiest approach. Its frequency range is 470-890MC and with the consideration that the ATV band is 420-450 MC, this leaves us with only a twenty MC difference between the low side of the commercial UHF and the high side of the ATV band.

Before we get into the actual conversion of the UHF converter, I think an explanation is necessary as to the commercial UHF problem.

Many cities have suffered in the sense that these UHF stations came on the air with great gusto and people bought converters to receive the new stations; however, they proved to be no competition with the VHF channels and soon disappeared from the scene. As to what the future has in store, it is rather difficult to say.

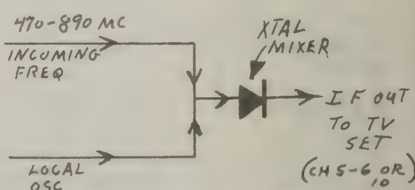
The reason for my delving into the commerical UHF problem and also our decision to use UHF converters for our receiving station is their great availability. We have always been searching for ways to save money in ATV for the reason that the cheaper an amateur can put a TV station on the air the greater number of us there will be. I use the word cheap in the sense of money and not quality!

I am sure that unless you live in a remote area of the U.S. you will be able to locate a converter within a radius of 50 miles of your QTH for a very reasonable price because of what has been stated previously.

At the present time we have a channel 17 in the Buffalo area. It is an educational channel creating very little interest...possibly because it is on the air a mere 4 hours a day. I am certain similar situations exist in many other parts of the country. We had no difficulty in locating these self-contained converters and in fact, all five of the ones presently in operation at our QTH were given to us!

On all the converters we have adjusted we found it made no difference as to the manufacturer or tube lineup; all results proved to be satisfactory. However, if a choice can be made as to the type, try to obtain one with an IF amp. It will tune sharper than one without, but will have greater gain so essential for distant reception.

The incoming frequency in the range of 470-890 MC (channels 14-83) is mixed in a crystal diode with a local oscillator signal (usually generated by a 6AF4 type tube) providing an IF output in the VHF channel range (2-13)...in most cases it will be channel 5 or 6. (In the case of the Regency two tube model it will be Ch. 10)



BLOCK OF UHF CONVERTER

Fig. 1

We have tried to adjust various UHF converters with signal generators, however most generators in the 450 MC range have outputs that are harmonics of some lower frequency, consequently, with intermixing of frequencies in the signal generator and the converter many false points can be obtained and this method was given up.

Two methods can be used, each will be found to be very easy to perform.

METHOD ONE: The first method is used in areas where there is a UHF channel in operation. (The frequency assignment for UHF television consists of 70 6 MC channels...14 to 83 inclusive, beginning at 470 MC and ending at 890 MC.)

Note: Be sure to set the TV receiver on the proper VHF channel...that is, the one that matches the output of your converter.

We will use Buffalo, N.Y. for an example. This station as mentioned earlier operates on channel 17, 488-494 MC. In this case, we simply tune to Ch 17 and begin adjusting the local oscillator till we have creeped the station up to ch 25 on the converter. This brings the ATV band into the channel 14 to 19 range.

As can be seen from the above, we are effectively tuning the received channel up the UHF band to bring the ATV band in the range of the converter. We tried this with many types of converters and found only one that would not tune in the range of the ATV band. In this case it was necessary to solder a 1-7 mmf variable capacitor across the L.O. coil. All local oscillators worked well and in no case did we lose oscillation.

METHOD TWO: The second method is to tune up your transmitter with lecher wires as suggested by WØKYQ in HAM TV, pages 83-85. Set the transmitter frequency to 435 MC, which puts you in the middle of the band. (A dummy load will suffice for this close range.)

Connect the antenna to the converter and adjust the L.O. slug on the converter to pick up the radiated test signal (a test pattern is best but not absolutely essential) till it can be received on channel 19 or higher. This will allow you to cover the entire band very easily.

It is difficult to pinpoint, which tuning adjustment is the L.O. in the converter due to the wide variety of models that are presently on the market. However, upon taking the converter apart, you should find no difficulty in determining which one it is. If necessary we suggest obtaining a print or schematic either from the manufacturer of Sams Photofact before starting; in fact, it would probably be a good idea anyway, should parts replacement or trouble shooting be necessary later on.

Should you be lucky enough to own a TV receiver with a UHF converter in it, use the same procedure as above remembering to adjust the rabbit ears or other type antenna to a 1/2 wavelength for best reception (usually 13-14 inches total length).

See you on ATV,
Joe Forth, WA2TRT

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ONE KILOWATT ON 420 MC

Effective January 2, 1963 the FCC will allow 1 KW operation on the 420-450 MC band subject to certain area restrictions. See the January issue of QST for full details.

****

470 mc if the full length of the lines could be used. (See figure 3) The travel of the shorting bars is limited by a small arm on the shaft which comes to rest against a pin on the wall of the converter. This arm is important as it prohibits the shorting bars from coming clear out of the lines as the low frequency end of the lines are open. One of two things must be done. Either the arm must be removed from

Fig. 2 The Mallory Inductuner

the shaft, the shaft rotated so that the shorting bars come almost to the end of the lines (leave a safe margin, you've got plenty of lee way) and then the arm replaced on the shaft; or the arm, which is perhaps ½ inch wide, must have it's end ground part way through to allow the necessary extension of the rotation range.

Either procedure will work nicely though the second one

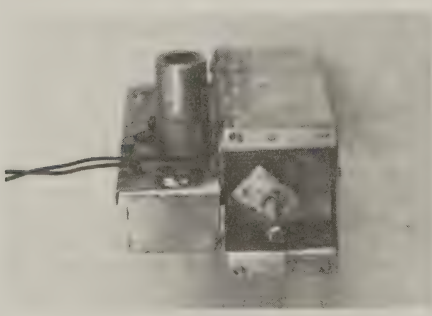

Fig. 3 Inside appearance of the Mallory Inductuner

has the advantage that it does not change the calibration for the regular UHF TV channels.

Access to the arm is a little difficult in that it is concealed behind a thin sheet metal flap which is actually part of the chassis folded across the front of the tuner. Though there are screws on one side, the flap is a permanent fixture and must be removed completely to allow access to the shaft arm. Undue the screws and grasp the flap firmly with a pair of pliers. With the pliers tear the flap back and bend it back and forth until it breaks at the fold point (or cut it with sheet metal shears). This will leave the arm exposed and ready for modification. You will now notice that the arm is mounted by means of splines on the shaft. Anchor the end of the shaft nearest the arm (the tuning knob end) in a vise and carefully work the arm loose with a pair of pliers.

Now rotate the shaft to the end of the lines (or grind the arm) and replace the arm so that it rests against the stop pin. Tap the arm back onto the splines and that is all there is to it. This procedure will move the tuning range down somewhere in the neighbor - hood of 100 mc and will allow operation of a conventional receiver over the entire 420-450 mc band as well as all or most of the commercial TV band.

THE RME MODEL 200: This unit uses two parallel tuned lines. One each in the antenna and oscillator circuits. These lines are thin strips of metal laid flat on a phenolic board and may be produced by printed circuit techniques. They are tuned by ganged movable shorting bars but there is no extra line length available so capacitive padding of the circuit is necessary. A small removable plate on the bottom

CONVERTING UHF TV TUNERS

FOR ATV

Jim Kennedy, K6MIO
2816 E. Norwich
Fresno, Calif.

A fast way to start receiving amateur television signals

Photos by:
Joe DeYoung, WA6CQL

With the advent of commercial and educational TV in the UHF portion of the spectrum, UHF TV tuners have become readily available in many parts of the country.

These converters may be either of the fixed channel type which allows a choice of pre-set channels or the tunable type. They tune a frequency range of 470-890 mc and have IF frequencies on either VHF channel 5 or channel 6.

Most of these tuners may be adapted to ATV operation in a matter of minutes and in most cases such adaptation will not seriously effect their usefullness as commercial TV converters.

These converters ususally use 6AF4 self-excited oscillators and diode mixers. Some have IF amplifiers and others do not. For best results IF amps should be added to those units which do not already have them.

Almost all of them use some form of parallel tuned line in the tuning circuits. Figure 1 shows a typical converter circuit.

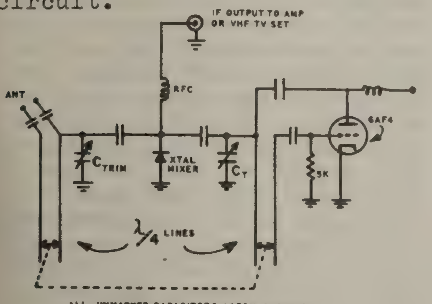

Fig. 1 Schematic of a typical UHF converter

THE SIGNAL: The signal enters through the antenna terminals and is coupled into a tuned line for image rejection. From there it is coupled to the mixer diode. The output from the local oscillator is also fed to the mixer diode and the IF signal, (antenna signal frequency minus local oscillator frequency or vice versa) is taken out through the RFC which will pass VHF but not UHF.

One of the following techniques may be employed in almost any make of tuner. The converters described were selected because they are each representative of a specific class of design.

THE MALLORY INDUCTUNER: This is the basic tuner used in the Blonder-Tongue Model BTU-2S.

The unit pictured in figure 2 however, was obtained separately from the rest of the converter.

This tuner has three parallel tuned lines. Two are in the antenna circuit and the third is in the oscillator. The lines are constructed of thin strips of sheet stock laid on edge and bent into circles. They are tuned by movable shorting bars which are connected to a common shaft so that all three lines are ganged together.

Close examination of the lines will show that in its unconverted state the travel of the shorting bars is limited to perhaps 250° of a possible 300° of rotation. In other words it has a built in capability of operation at frequencies considerably below

of the tuner chassis allows access to the bottom of the 6AF4 socket and one end of the lines. The lines are padded by two 4.7 mmf capacitors. One on each line. (See figure 4.)

The capacitors are added in parallel with the two trimmer capacitors already on the lines. This procedure allowed reception of a 445 mc TV signal on what the converter dial called channel 18 and allowed reception of the local UHF commercial channels though, of course, the dial calibration was no longer correct.

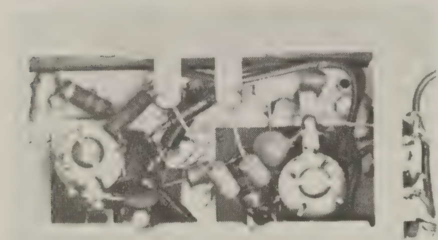

Fig. 4 Inside view of RME converter showing the padding capacitors to be added for ATV reception.

G.E. MODEL UHF 103: This converter differs from the first two in a couple ways.

First, it is a "in chassis add on type" unit and, second, it is a pre-set channel type.

This converter allows the user his choice of three preset UHF channels. The unit has a turret assembly which contains the 3 sets of tuned lines. Turning the knob switches in the correct set of lines.

The lines here take a different form in that they are spiral wound pairs of wires which have a threaded metal slug which acts as a shorting bar and travels up and down on the "threads" provided by the wire helices. (Notice: Jim has a limited number of these converters for sale..cheap.) Write for details. As is, the converters have sufficient range to cover the band. All that is necessary is to use the normal tune up procedure which involves inserting a tuning tool into the adjustment holes and with a signal of moderate strength going into the converter, tuning the oscillator until the signal is located. Then the tuning tool is used to peak the antenna adjustment and then the oscillator is tuned again until the other image or point where the signal is received is located. Select whichever point gives you the best signal and peak up the built in IF amplifier. That is all there is to it.

All three of these converters have been used at the author's home station and have been found to work quite satisfactorily. They will provide any ATV enthusiast with a cheap and easy ATV converter.

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AXT-2 xmtrs tuned to 385 mc and mixed with a 55 mc signal from a six meter rig will give you a 440 mc output for ATV.. ...with much better efficiency. Credit goes to Pete, W1YIX for this idea. AXT-2 xmtrs have been available from Arrow Sales Chicago for $15.95. Mention ATV Experimenter.

Live camera enthusiasts; Al suggests rear control of your optical focus and iris setting through the use of a rod and pulley arrangement (a gearing arrangement might be nicer but harder for the home constuctor to build). The rod, which can be mounted outboard or internally connects to the lens through the pulley combination and the other end of the rod extending out the rear of the camera will provide a much more convenient method of focusing and setting iris.

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Don Rudikoff of the Bronx recently completed the Parker TV camera and in the process obtained the following info from a technician at Sylvania: The yoke as described in the Parker article must have at least 22 ohms resistance to function properly in that circuit. Perhaps this explains why so many fellows had trouble with the horizontal stage.

INEXPENSIVE OPTICS FOR FLYING SPOT SCANNERS

Les Toth
1242 E. Fair Ave.
Lancaster, Ohio.

After the first thrill of obtaining a picture from a simple flying spot scanner, most hams notice that the quality of the picture could stand improvement.

Most simple scanners are built without any optics, that is the transparency is placed directly in front of the CRT, thus modulating the light beam emitted by it, which eventually strikes the photocathode of the photomultiplier tube. It is obvious that the transparency should be as close to the light source as possible, otherwise the picture will be defocused. Being that the faceplate has a finite thickness it is impossible to obtain perfect focus. The curvature of the faceplate will also impose a separation between the light source and the transparency to be transmitted. An other disadvantage of this system is its lack of adaptability to scan 2 x 2 slides if a 5" or bigger tube is used. If the soans are compressed, loss of detail will result, due to the fact that the CRT can resolve only a limited number of picture elements per inch. In the case of most 5" CRT's this figure is approximately 70-100/inch, which in the case of a 2 x 2 slide would result in approximately 150 line resolution, or in other words less than half of what a home TV set is capable of.

One relatively inexpensive solution to these problems is to use a slide projector "in reverse" for the optical system of the flying spot scanner. Any projector can be adapted for this job, however one with the capability of focusing at close range would be better.

The modification consists of removing the projection lamp, its socket, and the cooling fan. The photomultiplier is installed in place of the projection lamp, and the preamplifier in any convenient space. The latter might present problems in some of the small projectors, however with a little ingenuity this problem can be solved.

Fig. 1 shows how this arrangement works: light from the CRT is collected, passed through the slide, then focused on the photocathode of the photomultiplier tube.

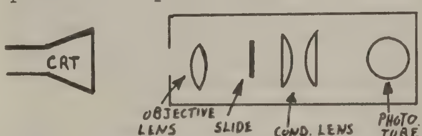


Fig. 1 Simple optics for FSS

This system allows not only the transmission of slides in the projector...if the slideholder is left empty a transparency can be placed directly over the CRT, or a message can be written on the faceplate with a grease pencil. HINT: (1) Some projectors are not designed for close focusing. It might be necessary to extend the range by bringing the projection lens forward. (2) It is advisable to mount the photocell socket such that it can be moved for correct positioning.

K4DQO, Bernie has made several modifications on his AXT-2 transmitter inorder to get up to frequency with sufficient drive. He cut off the oscillator plate lines and made a ½ wavelength out of them; put a butterfly at the end and feeds the B+ to the lines thru a couple RF chokes. This allows him to cover the band with a fairly good signal indication on a 10 watt lamp. I picked up his carrier and sync buzz at my QTH.

I am just about ready to put my APT-5 on the air...at the present we are experimenting with the video output from the ATJ camera. I seem to have too much video as the modulator has terrific gain. I left the 931A tube in this transmitter to use as a test modulation indicator. Believe it would be possible to make a hole in the cabinet and the 931A housing and use it as a scanning camera pickup. But as I have an ATJ camera I haven't gone into this phase. Lecher lines come with the APT-5 transmitters so no difficulty in locating the correct frequency will be experienced.

We have given a number of demonstrations to hams here using the ATJ camera pointing out the back door with plenty of sun. Real nice pictures are obtained on the TV set using a modified UHF converter connected to a dummy antenna. Here is how I do it. Take two stiff wires the right size to fit a Mosley TV female plug. Attach wires to the plug and to the antenna screws on your UHF converter. Cut a piece of the heavy round type TV lead about 15½ inches long. Solder wires at both ends and cut one of the wires at the middle of the folded dipole and attach to a piece about two inches long. Put a Mosley Male plug on the other end and plug it into the female socket on the UHF converter. See fig. 1.

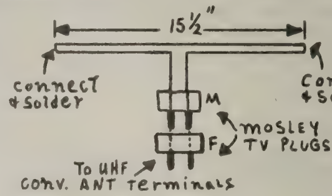


Fig. 1

I also have similar connectors on my TV antennas so that I can plug into the low power transmitter direct or into the balun which I use on the APT-5 and AXT-2. This is a 50 ohm balun to 300 ohm such as described in the HAM TV book except it is used in reverse. I find my APT-5 loads into this balun to the 300 ohm feed on my Cushcraft 11 element yagi very effectively.

W4LSA

Users of ART-26's following K6MIO's conversion may find a considerable improvement if, instead of using a 25mmf fixed capacitor between the grid terminal and the grid shield a small variable capacitor is used and with the transmitter loaded into the normal antenna this capacitor is then tuned for maximum output as indicated on a remote field strength indicator. A Johnson no. 189-6 subminiature...cap 1.8 to 13 mmf works excellent.

Several good hints: (1) If you don't have a lens for your ATJ Ike camera you can take a reading glass, such as found in variety stores, (they usually sell for about a dollar) remove it from the frame and remount on the camera focusing housing...using the regular lens mount as the outer retainer. Vic says, "Have used such a system at our QTH and find that picture detail is good. Lens seems to have sufficient light capability and we cannot detect any detail loss over regular lens that came with the camera." (2) A cheap and easy converter for ATV is the receiver front end from an APS-13, tail warning radar. As you know they are less than $2.00 on the surplus market and will give an IF output on the lower TV channels without modification. While true they are noisy and unstable, they do provide a cheap and easy method of converting your ATV signal to your regular TV receiver.

Going way back to the May, 1957 CQ article on the ATK/ATJ camera conversion article it is brought to our attention that the bias rect are shown in the wrong polarity. Also, for better regulation the 83 can be replaced with 400 PIV 500 ma silicon rectifiers.

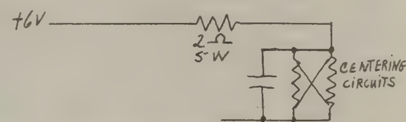
W4JSC/4, Hans from Tampa draws to our attention a drawing error in the TV converter diagram on page 92 of the HAM TV book. The .001 mf condenser on pin 7 of the 6BQ7A should go to ground instead of to pin 8 as shown.

Les Toth, Lancaster, Ohio suggests a few modifications for the ID66/AXR-1 TV monitor that appeared in ATV #2.

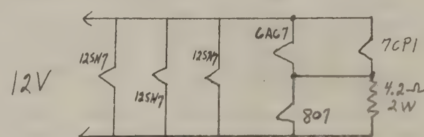
Add another coax input connector for the sync. This makes it possible to loop through or terminate it which ever is desired. Terminations for video applications are usually made by soldering a 75 ohm (2-150 ohms in parallel) in a male UHF connector.

To make the ID 66/AXR-1 into a mobile monitor modify as follows:

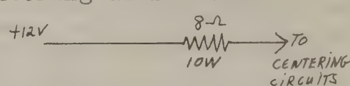
6V-Replace 12SN7s with 6SN7s
Wire all filaments in parallel. Centering:



12V-Use 12SN7s with all wired in parallel...except the 6AC7 and 807 and CRT. See sketch below:



Centering as follows:



For B+ use either a dynamotor or mobile power pack.

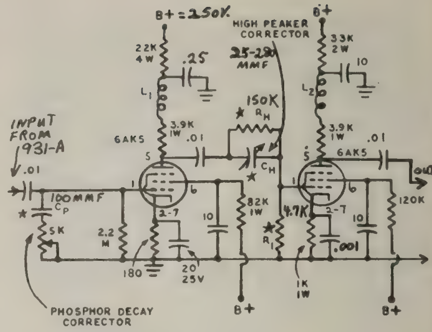
Ted Cohen, W9VZL/9, from the Univ. of Wisconsin in Madison sends us this hint: Sharp QSL cards can be made by taking a pix of your ID slide off your monitor and use this pix on your cards. Very impressive.

5FP5 CR TUBE GOOD FOR FSS CAMERA

The price of some tubes may be on the increase but fortunately this is not the case with the 5FP5. Prices are down to an all time low...about $4 from some surplus houses at time of this printing. These tubes make very good light source tubes for flying spot cameras. Their quality is as good if not slightly better than the 5AXP4 or 8XP4 TV serviceman substitution tubes (a FSS favorite, selling for about $20) and considerably better than the surplus 5FP7 tube which has been extremely cheap for quite some time from most surplus sources.

The 5FP5 requires no ion trap but does require a focus coil. If you have a permanent magnet type focus unit (from a discarded TV set) this will work fine...otherwise a standard focus coil will serve the purpose. The decay time of the P5 phosphor is somewhat faster than the P7 and considerably faster than the P4. To correct for this, use a correction network as shown in the illustration below.

Adjustment merely consists of setting the phosphor corrector to the point where it just eliminates a kind of ghosting effect. The high peaker is adjusted for elimination of smear. When the latter is improperly set the picture will have either positive or negative smearing...depending on whether too much or too little capacity is present in the circuit. Negative smearing means the smear is the opposite shade of the original figure (white smear following a black figure and black smear following a white figure). Positive smear means the smear is the same shade as the original figure.



Unless otherwise stated, all condensers in mfd and resistors are ½ watt.

* indicates correction network components.

L_1 & L_2 125 turns No 30 enamel wire wound on 100K, 1 W resistor scramble wound.

******

Cush Craft Antennas of 621 Hayward St., Manchester, N.H. makes very FB 16 element collinear array for 430 mc. Model #CL416...$9.85 ham net. Has 13.2 DB gain.

******

SUBSTITUTION FOR THE 931-A

With increased demand on the 931-A photomultiplier tubes for flying spot scanner cameras the price seems to be climbing and is presently around $5.

However, the 931 is a direct replacement and works nearly as good as the 931-A. It can presently be obtained from various surplus sources for about $2.00!

GLOSSARY OF ATV TERMS

By Mel Shadbolt WØKQY

ABERRATION: In lenses this is divided into two categories; color distortion known as chromatic aberration and image distortion known as chromatic aberration. Also used to define image distortions in the electron lens system of CR tubes and image converter tubes.

ANODE: The plate on any vacuum tube.

APERTURE: The size opening which determines the size of a beam of light or stream of electrons.

ASPECT RATIO: The numerical ratio of picture width to height. Present commercial standards call for a ratio of 4:3.

BACK PORCH: That portion of the composite video signal which lies between the trailing edge of the horizontal sync pulse and the trailing edge of the corresponding blanking pulse. Note: This does not apply to industrial and amateur pulses which incorporate a single pulse for both sync and blanking.

BANDWIDTH: The number of CPS expressing the difference between the limiting frequencies of a frequency band. Example: A video signal extending from 440-445 mc has a width of 5 mc.

BLACK COMPRESSION: A non-linear amplification of signals in the black and near black regions of the picture thus modifying the tonal gradient.

BALOP: Abbreviation of baloptican; a system for the projection of opaque material for pickup by a television camera.

BANDPASS FILTER: A filter network which allows only a certain band of frequencies pass through it rejecting anything above or below its cutoff frequency.

BLACK PEAK: This is the maximum excursion of the video signal in the black direction at the time of observation.

BARREL DISTORTION: Image distortion where the sides of the picture bulge outward.

BLANKING: Pulses whose instantaneous amplitude make the vertical and horizontal retrace invisible.

BLANKING LEVEL: The level of the front and back porches of the composite video signal.

BLEEDING WHITES: White areas in the video signal seem to run irregularly over into the black areas. This is an amp overloading condition.

BLOOMING: An enlargement of the spot size and halation of the fluorescent screen of cathode ray tubes. Occurs in areas where the brightness is at an excessive level.

BOUNCE: Sudden variation in the brightness level of a video signal caused by power line variations, etc.

BREATHING: Similar to "bounce" but at a slower regular rate.

BURNED -IN IMAGE: An image which persists in the output signal or a camera even after the camera has been repositioned on another scene.

CATHODE-RAY TUBE: A type of vacuum tube which has an electron gun arranged to direct a beam of electrons upon a fluorescent screen. This action causes the screen to glow wherever the electrons strike.

CHROMINANCE SIGNAL: That portion of the NTSC color television signal containing the color information.

CLAMPER: A device which functions during the horizontal blanking or sync interval to fix the level of the picture signal at some predetermined reference level at the start of each scanning line.

CLAMPING: The process of establishing a fixed level for the video signal at the start of each scanning line.

CLIPPING: The cutting off of the peaks of a signal. This may be done in either the white or black regions of the video signal.

COLOR BURST: In NTSC color, it refers to a burst of about 9 cycles of 3.6 mc subcarrier on the back porch of the composite video signal. It serves as a color synchronizing signal to establish a frequency and phase reference for the color signal.

COLOR SUB-CARRIER: In NTSC color, it is the carrier whose modulation sidebands are added to the monochrome signal for the purpose of conveying color info. The frequency is approximately 3.6 mc...actually, 3.579545 mc.

COMA: An image defect sometimes occurs in lenses and electron guns inwhich the image-forming spot is no longer round but comet shaped.

COMPATIBLE COLOR SYSTEM: A color TV system which produces a color signal that can still be detected as a black and white picture onmonochrome receivers without modification.

COMPOSITE VIDEO SIGNAL: The entire video signal containing video, blanking and sync.

COMPRESSION: A less than proportional change in output of a circuit for a change in the input level. The most common form of compression is sync compression.

CONTRAST: The ratio of whites to blacks in a picture.

DEPTH OF FIELD: The distance nearer or further than the distance on which a lens is focused which appears acceptably in focus.

DETAIL: Similar to definition or resolution. It refers to the most minute elements in a picture which are distinct and recognizable.

DIFFERENTIAL GAIN: The amplitude change of a video signalas the blanking level is varied between black and white. Usually the video signal is a 3.6 mc subcarrier.

DIFFERENTIAL PHASE: The phase change of a 3.6 mc subcarrier as the subcarrier is varied from blanking to white level...measured in degrees.

DRIVING SIGNALS: Signals that time the scanning in cameras, etc.

DYNODE: One of the electron-emitting components in the electron multiplier section of a photomultiplier tube or pickup tube. It amplifies the current emitted from the photocathode through the action of secondary emission.

ECHO: A wave which has been reflected at one or more points in the transmission medium with sufficient magnitude and time difference to appear as reflections or "ghosts" on the picture monitor.

ELECTROSTATIC FOCUSING: A means of focusing an electron beam by the action of an electric field.

EQUALIZING PULSES: Used to minimize the effect of line-frequency pulses on the interlace. Not used in ATV random interlace systems.

FIELD: One-half of a complete picture (or frame) interval in an interlaced system containing all of the odd or even scanning lines of the picture.

FIELD FREQUENCY: The rate at which a complete field is scanned. In our system this is 60 CPS.

FLASH: A momentary interference to the picture lasting approximately one field or less and of sufficient magnitude to totally distort the picture information. Generally used only when the interference lasts for such a short duration that the basic impairment cannot be recognized.

FLICKER: The perceptible variation in brightness when a series of images are presented on a screen at too slow a repetition rate.

FOCUSING: The process of controlling the convergence and divergence of an electron beam.

FOLLOWING (or TRAILING) BLACKS: A condition when the edge following a white object is overshaded toward black.

FOLLOWING (or TRAILING) WHITES: A condition when the edge following a black or dark gray object is shaded toward white.

FOOT-CANDLE: A unit of incident light equal to the light from a 1 candlepower source at a distance of 1 foot.

FOOT-LAMBERT: A unit of luminance equal to the uniform luminance of a perfectly diffusing surface emitting or reflecting light at 1 lumen per sq. ft. NOTE: As foot-candle is the unit of incident light, foot-lambert is the unit of emitted or reflected light.

FRAME: In interlaced scanning it refers to both the odd line field and the even line field.

FRAME FREQUENCY: The rate at which a complete frame is scanned. This is 30 CPS for the standard interlaced signal and 60CPS for non-interlaced signal.

FRONT PORCH: That portion of the composite picture signal which lies between the leading edge of the horizontal blanking pulse, and the leading edge of the corresponding sync pulse. Often not used in industrial and ATV combination sync-blanking type pulses.

GAIN FREQUENCY DISTORTION: A type of distortion inwhich all the frequency components of a signal are not transmitted with the same gain or loss. The frequency response of the system is said to no longer be "flat".

GAMMA: A term that refers to the relationship between the input and output of a TV system or part of a system. It relates the brightness of a part of the televised scene with the brightness of the corresponding part of the reproduced image. Also known as gray scale rendition.

GHOST: A shadowy image in the received picture offset either to the left or right of the primary image. A ghost displaced to the left of the primary image is designated as "leading" and the one to the right is designated as "lagging". When the tonal variations of the ghost are the same as the primary image, it is known as a "positive ghost"...when it is the reverse, it is known as a "negative ghost".

GLITCH: A type of low frequency interference, appearing in the form of a narrow horizontal bar moving vertically through the picture.

HALO: Usually, a dark area surrounding a very bright object caused by overloading of the camera pickup tube. Reflection of studio lights from shiny objects such as jewelry might cause such an effect. Under certain conditions it is possible for a white "halo" to surround dark objects.

HIGH-LIGHTS: The maximum brightness of the picture occurring in the regions of highest illumination.

HORIZONTAL BLANKING: The signal which extinguishes the scanning beam at the end of each scanning line for the duration of the retrace.

HUE: In everyday usage, it corresponds to "color"; i.e., green, blue, red, etc. Black, white and gray do not have hue.

ICONOSCOPE: A camera pickup tube employing a high-velocity electron beam which scans a photoemissive mosaic having electrical storage capabilities.

INCIDENT ILLUMINATION: The light that falls upon an object to illuminate it.

INTERLACE: To intersperse alternately two or more sets of scanning lines or fields.

ION SPOT: A spot on the fluorescent surface of a CRT which is somewhat darker than the surrounding area due to bombardment by negative ions which reduce the sensitivity.

ION TRAP: An arrangement of magnetic fields and apertures designed to allow an electron beam to pass through but to obstruct any ions.

JEEPING: Modification of a TV receiver to allow video to be fed directly to the video amplifiers.

JITTER: Partial loss of synchronization causes this problem. It may refer to individual lines or to the entire field.

KINESCOPE: Film recordings made directly from the face of a picture tube. Also refers to picture tubes in general.

LEADING BLACKS: A condition when the edge preceding a white object is overshaded toward black.

LEADING WHITES: A condition when the edge preceding a black object is overshaded toward white.

LINEARITY: In TV it refers to the geometrical spacing of the picture elements in the received picture as compared to the original scene. Lack of linearity is referred to as geometric distortion.

LINE SCANNING FREQUENCY: The number of horizontal scans per second. 15,750 cps for U. S. standards.

LUMINANCE SIGNAL: The black and white (brightness) portion of a color signal.

MOIRE: A wavy or satiny effect produced by convergence of lines. It's a natural optical effect caused when converging lines in the picture are nearly parallel to the scanning lines.

MONITOR: A cathode ray tube and associated circuitry used to display the televised picture.

MULTIPLIER PHOTOTUBE: More commonly referred to as a photomultiplier tube, it has several secondary emission electrodes called dynodes that amplify the current emitted from the photosensitive cathode. Through secondary action, the signal emitted from the cathode can be amplified thousands of times.

NEGATIVE IMAGE: A picture signal having a polarity which is opposite to normal polarity...whites appear black and blacks appear white.

NTSC: National Television System Committee.

NOISE: The word "noise" is a carryover from audio practice and refers to random spurts of electrical energy or interference. Commonly referred to as "snow".

NON-INTERLACED: Scanning lines transmitted in a progressive order.

ORTHICON (conventional): A camera pickup tube in which a low-velocity electron beam scans a photoemissive mosaic on which the image is focussed optically and which has electrical storage capabilities.

ORTHICON (image): A camera pickup tube in which the optical image falls on a photoemissive cathode which emits electrons that are focussed on a target at high velocity. The target is scanned from the rear by a low-velocity electron beam. Return beam modulation is amplified by an electron multiplier (similar to the multiplier section of photomultiplier tubes) to form an overall light-sensitive device.

OVERSHOOT: Sharp "spikes" usually occuring just before or just after the sync or blanking pulses or any other areas in the pictures with sharp edges. It is due to excessive response to a unidirectional signal change.

PAIRING: A partial or complete failure of interlace in which the scanning lines of alternate fields do not fall exactly between one another but tend to fall one on top of the other (in pairs).

PEDESTAL: An obsolete term referring to the blanking.

PEDESTAL LEVEL: Also an obsolte term referring to the blanking level.

PERSISTENCE: In television, this refers to the length of time the screen of a cathode ray tube remains luminescent after being excited by an electron beam.

PHOTOCATHODE: A surface chemically treated to emit electrons in the presence of light.

PHOTOCONDUCTIVE: The ability of certain chemicals to change resistance to the flow of electrical current under varying degrees of illumination.

PHOTOEMISSIVE: The ability of certain chemicals to emit electrons upon exposure to light.

PICKUP TUBE: Any photosensitive tube which is capable of transforming optical images into an equivalent electrical signal.

PIGEONS: A type of impulse noise observed on picture monitors as pulses or bursts of short duration, at a slow rate of occurence.

PIN-CUSHION DISTORTION: A distortion to the picture inwhich the sides bulge inward.

POLARITY OF PICTURE SIGNAL: Refers to the polarity of the black portion of the signal with respect to the white portion of the signal. Normally a "black negative" picture is present at the output of any piece of equipment. Also, a "black negative" picture is transmitted when using American standards. This means the black portions of the picture are negative going with respect to the white portions of the picture.

RANDOM INTERLACE: A modification of the original 2:1 interlaced standard used by broadcast stations utilizing a less precise timing of the sweep frequencies. Generally in ATV and CCTV work, the vertical scan is locked to the 60 cps power line while the horizontal scan is nothing more than a free-running oscillator.

RASTER: The scanned area of the picture tube.

RESOLUTION: Refers to the amount of fine detail a system can reproduce. Vertical resolution is primarily limited by the number of scanning lines while the horizontal resolution is dependant on the high-frequency amplitude and phase response of the system.

RF PATTERN: A type of interference which produces a herringbone pattern of varying size (depending upon frequency) in a TV picture.

RINGING: Oscillatory transients appearing as closely spaced multiple reflections in the picture particularly noticeable following small contrasty components in the video signal.

ROLL-OFF: The gradual attenuation of the high frequency components at either or both ends of the transmission passband.

SCANNING: The process of breaking down an image into elements by means of a moving electron beam and transmitting this information in a systematic manner.

SCANNING LINE: A single continuous strip of the picture area (achieved through the process of scanning) containing all the tones contained in the original scene.

SEQUENTIAL COLOR TRANSMISSION: A system of color transmission in which the three primary color signals (red, blue and green) are transmitted one after the other. The three basic types of sequential color include: line sequential, field sequential and dot sequential.

SERRATED PULSES: A group of equally timed pulses within a pulse signal. i.e., The vertical sync pulse (in interlaced sync) is serrated with a group of horizontally timed pulses in order to keep the horizontal sweep circuits exactly in step during the vertical sync interval.

SERRATIONS: A term used to describe a picture defect inwhich the vertical and near vertical lines have a sawtooth appearance. This is caused by the scanning lines starting at slightly different points during the horiz. scan.

SETUP: Refers to the separation level between the blanking and reference black levels. Not applicable to combination sync/blanking industrial-amateur type pulses.

SMEAR: A term used to describe a picture defect inwhich the televised objects appear to be extended horizontally past their normal boundaries in a blurred manner.

SNOW: Random noise in the visual channel.

SPIKES: See overshoot.

SPECTRAL RESPONSE: Refers to the relative sensitivity of a photo sensitive pickup device (phototube, vidicon, etc) to different wavelengths within its range of sensitivity.

STREAKING: A term used to describe a picture defect inwhich the televised objects appear to be extended horizontally past their normal boundaries; particularly evident at vertical edges of objects when there is a large transition from white to black or black to white. The streaking can be either positive or negative. When the streaking is the opposite polarity as the object, it is negative streaking. When of the same polarity, it is positive streaking. Streaking is the result of low-frequency distortion.

SWEEP CIRCUIT: A circuit that produces the scanning motion of the electron beam in both, picture tubes and image converter tubes.

SYNCHRONIZATION: The process of keeping the scanning beam at the distant receiving point in step with the beam in the camera at the originating point.

SYNC: Abbreviation for the words "synchronizing" "synchronization" etc.

TEARING: Lack of horizontal synchronization resulting in a picture condition inwhich groups of horizontal lines are displaced in an irregular manner.

TRANSFER CHARACTERISTIC: See gamma.

VESTIGIAL SIDEBAND TRANSMISSION: A method of transmitting a video signal inwhich a portion of one sideband is suppressed to conserve bandwidth.

VIDEO: A term referring to the visual portion of television.

WAVEFORM: The graphical representation of a signal as observed on an oscilloscope.

GAMMA

Bruce Robinson, VE9OX
297 Yonge St.
Kingston, Ont., Canada

The term "gamma" has been called the most abused technical term in television. Yet, unless we confine ourselves to certain picture sources, gamma is an important factor in producing the highest quality pictures.

To describe what the term is all about, consider a flying spot camera-transmitter, as described in WØKYQ's book HAM TV. It's common practice to break a system like that up into a number of small blocks, each of which has a signal input and output. (See figure 1.)

In the case of the photomultiplier tube, the input is illumination from the negative; the output is an electrical signal. The term gamma describes the relation between input and output of a device, whether it be photomultiplier, modulator, or entire transmitter. In normal operation, the output voltage of a photomultiplier (E_o) is fairly closely related to the light reaching its photosensitive cathode (I_k) by a particularly simple equation:

$$E_o = kI_k$$

where k is a proportionality constant. The equation is linear, and the gamma is said to be 1.0.

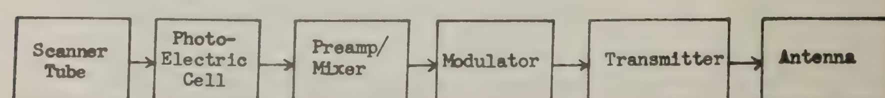
Consider the relation between the light output from a cathode ray tube in a monitor, and its signal voltage. The number of factors influencing the behavior of a picture tube is staggering, but to a reasonable approximation,

$$I_o = kE_g^{2.2}$$

where I_o is the light output, E_g the signal voltage above cutoff, and k is another of those constants. Here the gamma is 2.2. Doubling the drive voltage has the effect of more than quadrupling the light intensity.

The third letter of the Greek alphabet "γ" is used as the symbol for gamma. Note that it has significance only when the relation between the input and output of the device under consideration may be expressed in power form i.e. (Output) = k(Input) . Fortunately, most camera tubes, amplifiers, modulators, etc do behave in this way.

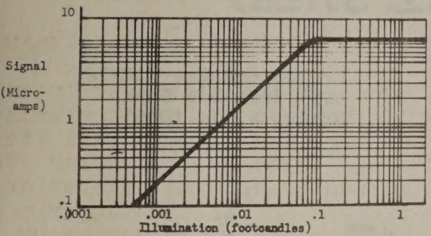
In order to determine the value of gamma, the input and output of a device are measured in its normal operating range, and plotted on log-log graph paper. A straight line is then "eyeballed" in place as the best compromise line through the points. The slope of this



Block Diagram of Flying Spot Camera-Transmitter

FIGURE ONE

line is "γ". Values range from about 0.3 for an iconoscope to the above mentioned 2.2 for a kinescope. (Figure 2)



Typical Transfer Characteristics - Image-Orthocon

FIGURE TWO

For an ideal television system, the illumination on the receiver screen should be proportional to the scene's illumination. i.e. the overall gamma of the system should be 1.0. Most items like preamplifiers, receiver r.f. and video stages and transmitters are fairly linear and have a "γ" of 1.0. The bad performers are often the first and last links in the chain:

CAMERA TUBE	TYPICAL "γ"
Image Dissector	1.0
Iconoscope	0.3
Image Iconoscope	0.3
Image Orthicon	*
C.P.S. Emitron	1.0
Vidicon	0.65
Monoscope	1.0
Flying Spot Scanner	1.0

*linear to very low

A TV system with flying spot scanner ("γ"=1), transmitter ("γ"=1), receiver ("γ"=1) and kinescope ("γ"=2.2) has an overall "γ" of 2.2. The result is an exaggeration of contrast, a picture harsher than the original.

That's where gamma correctors come in. They are non-linear devices that correct the system "γ" to 1. In theory, they could be inserted anywhere between the camera tube and the kinescope. In practice, they are inserted at the camera, to facilitate switching of program sources.

Gamma correctors are composed of two sections. The first, a dc restorer stabilizes the black level at a certain specific voltage. Since the input signal amplitude is controlled, then a definite voltage also exists for the white level. This is necessary to insure that the operation is independant of the picture content. The restorer is followed by a non-linear stage. One common circuit introduces the correction by using negative feedback. See figure 3.

The gain of this stage is influenced by the cathode impedance. As the input becomes more positive (black) the cathode exceeds the bias voltages of the crystal diodes one by one. As each diode conducts, it places an additional shunt across the original cathode resistor, thus raising the stage gain in gradual steps. Signals near the black level are amplified more than signals near the white level; gamma compensation has been accomplished, as the circuit has a "γ" less than one. If it is adjusted to have a gamma of 0.45, then it will compensate closely a system, like a flying spot scanner, where the only other non-linear device is the kinescope.

Gamma control can produce higher fidelity pictures and is recommended to those with an interest in producing the very best pictures.

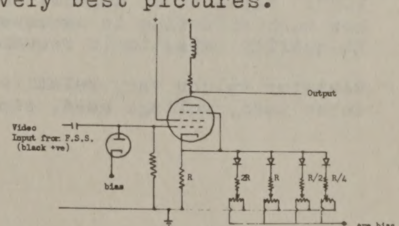
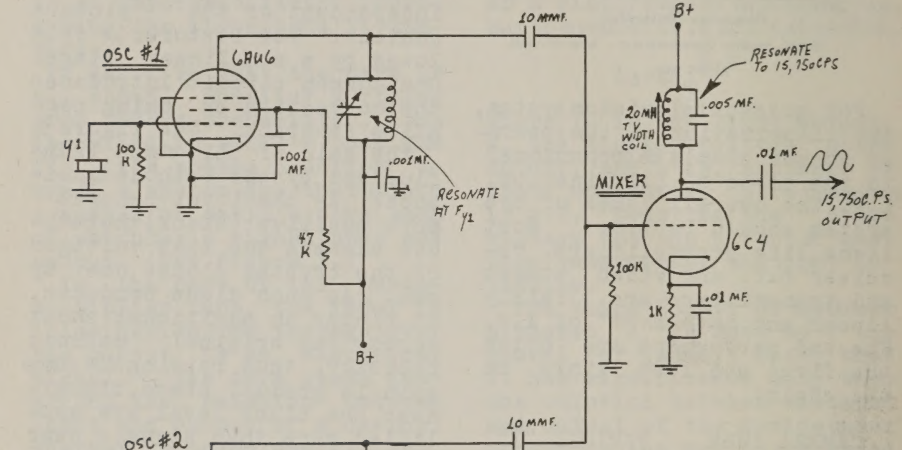


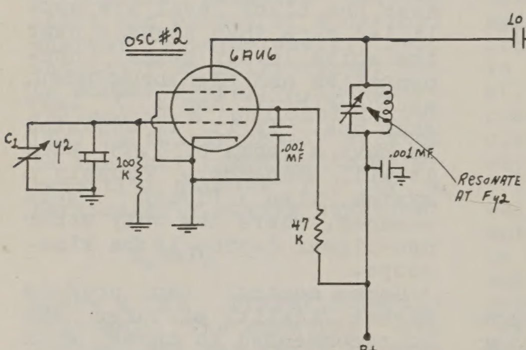
FIGURE THREE

A NOVEL APPROACH TO XTAL CONTROLLED HORIZ. SWEEP

Want crystal stability in your horizontal sweep...cheap? Then try this circuit...it substitutes two readily available 50¢ surplus crystals for the expensive hard-to-find 15.75 kc rock!

Irv Oppenheim, WA2WIJ
1664 Macomb's Road
Bronx, N.Y., 10453





NOTE: Value of C1 depends on how much adjusting is necessary. Hi-quality capacitor is recommended.

Resistor values vary relative to tubes used, voltage used, etc.

HOW IT WORKS

15.75 kc xtals are expensive. However, higher freq. xtals can be obtained very cheap and are available in a wide variety of values ranging from 13 to 18 kc apart. Select two such values. If their separation is greater than 15.75 kc place lowest freq. one in OSC #1. If the separation is less than 15.75 put lowest freq. one in OSC #2 By adjusting C1 in OSC #2 the difference freq. can be made exactly 15.75 kc. This difference signal is obtained by feeding the output of the two oscillators to the mixer tube, the output of which is tuned to 15.75 kc.